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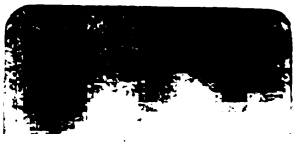

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# THE WIRELESS AGE

Owing to the fact that certain statements and expressions of opinion from correspondents and others appearing in these columns from time to time may be found to be the subject of controversy in scientific circles and in the courts, either now or in the future, and to sometimes involve questions of priority of invention and the comparative merits of apparatus employed in wireless signaling, the owners and publishers of this magazine positively and emphatically disclaim any privity or responsibility for any statements of opinion or partisan expressions if such should at any time appear herein.

OCTOBER, 1915

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# A Talk With the Operators

## Wireless Communication from the Viewpoint of the Man on Shore—The Value of Courtesy, What to Do and What Not in Disposing of Traffic, Something About Transmitting Through Static and General Comments on Speed, Superfluous Words, Coil Tests, Idle Gossip, Poor Spacing, Abbreviations and Service Messages

**By N. E. Albee**

*Manager Marconi Station at Cape Hatteras*

THERE are many emergencies in the daily routine of wireless work not covered by government regulations or official instructions. This may be partly accounted for by the fact that the men responsible for these orders depend largely upon the operators to keep posted. The process verbal, or log, is an illustration of how this information is obtained.

A better understanding between the operators at ship and shore stations would be of immense benefit to all of us and greatly improve the efficiency of the service. This article is not intended to cover the entire situation, for that would be a very difficult task for one person to accomplish. It is earnestly hoped, however, that what I have written will be instrumental in drawing forth similar articles from other operators who may offer additional suggestions.

The trying circumstances connected with our work—circumstances which tax the operator's patience to the utmost—are many. It has often been said that it is impossible to be a Christian and a wireless operator at the same time, but let us hope that conditions have not reached such a pass. It goes without saying, however, that the wireless man occasionally is ruffled and says as much as law and prudence will allow. During the early days of wireless, before the government took charge of the incorrigibles, the latter were prone to voice thoughts that would shock an outsider. Terrific battles were fought in the ether and only distance prevented physical encounters. We are glad, though, that times have changed and that we can deal with one another in a more courteous manner. At times, even now, a few uncomplimentary epithets are hurled into space, but it is noticeable that personal feeling rarely exists.

I have often thought of the sentiment contained in the Marconi Ideal, as recently presented by our vice-president and general manager on the back cover of THE WIRELESS AGE, and wondered if it were not possible for us to be more like him. Its logic and worth can only be realized by those who have cultivated and experienced his precepts. A word spoken harshly to a friend, fellow worker or subordinate often causes a sting that lingers indefinitely, though apparently forgotten. Remembering the old adage that "man can never master others until he first masters himself," we see that when he loses his self-possession he eventually loses control of those under him, and when he allows his inward feelings to become prominently displayed outwardly he is at a great disadvantage in dealing with his fellow-men. It has been observed that when a man becomes imbued with disagreeable qualities he not only displays them to his associates, but carries them home where something of the same spirit is instilled into the minds of his family.

Courtesy commands respect and admiration for the man, be he humble or



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great. It inspires others to do his bidding with good will, promptitude and great earnestness of purpose. Man can cultivate almost any habit he desires, whether good or evil, and it is surprising what a short space of time is necessary for it to become a real part of him. That the Marconi Ideal is deep rooted and a reality is evident to all who come into personal contact with the various officials of the Marconi Company; hence it is our duty to live up to the same standard.

Before the service can be materially improved it will be necessary for us first to ascertain and then eliminate the causes of interference. Numerous reasons may be offered in explanation, but boiled down, they amount to careless watch, poor judgment, useless work, inexperience and inefficiency. The fault is greatest in the order named.

When a careless watch is maintained it is impossible to follow the proceedings accurately. One of the chief difficulties the coast station has to contend with are calls from ship operators while the former is receiving traffic from another vessel. It is plainly evident that few adhere to the five-minute rule prescribed by law. When it is known that the coast station is not working with any ship or shore station it would be a waste of time to remain inactive for five minutes. But if there is any doubt or, to be more explicit, if the operator is not certain the coast station is not actually engaged in handling traffic, he should refrain from calling until the five minutes have elapsed.

Operators on freight ships should pay attention to this rule, for when an operator comes on duty at various times during the day it often happens that the coast station is working with some ship outside of his range and he is not able to hear the message which is being sent. Preference is sometimes given to the freight ships so as not to unduly prolong the working hours of the operator. Preference, consistent with the nature of the message, is always given to ships known to have only temporary power. There are scores of ships built long before wireless telegraphy came into existence and suitable provision has not been made for supplying constant power, although to comply with the law they start the one dynamo aboard whenever requested to do so by the operator. Yet the chief engineer does not care during the day to run the ship's dynamo for what he considers an unnecessarily long time; therefore we favor vessels of only temporary power whenever the circumstances are known and conditions will permit. In return we ask the operator to be equally considerate about calling.

On passenger ships, where the operators are required to maintain constant watches, there should be little to hinder them from keeping in close touch with radio work at all times. There are times, such as on the occasion of a passenger filing messages for transmission, when the operator's attention is temporarily diverted to other things. It is immediately following circumstances of this nature that he calls the coast station without first ascertaining whether the latter is clear. Some operators make the figure 4 (meaning are you clear), which is a very good method provided they wait until the station answers and do not follow it up after a short interval by calling the station, as is often the case. If we started the machine and answer "no" we should in all probability lose several words of the message being sent to us because the noise of the motor drowns out weak signals. When the sending station ceases for the moment then AS, QRT, QRX or K is given to the operator making the figure 4.

If a station operator gives a ship operator QRT or QRX and does not give him clearance within a reasonable length of time, the ship operator is justified in proceeding to dispose of his business. When I say reasonable time I mean that a station should be entitled to clear all ships calling it first.

Poor judgment often comes from inexperience and lack of familiarity with the general method of handling business. Operators of the old school, i.e., those who have grown up with the business, have a capable way of handling traffic with a minimum amount of work and are

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able to transact a surprisingly large amount of business even in the most adverse circumstances. Static, or strays, as they are scientifically called, tax the ingenuity of every operator and it requires no little skill in receiving and disposing of messages under such conditions.

I quote from Special Order No. 33 as follows:

"Consideration for the receiving operator should be the guiding principle when transmitting through static. To transmit a message at high speed when static renders reception difficult at even low rate of speed, results only in loss of time and energy.

"The number of repetitions required and the speed of transmission should be determined by the nature of the prevailing static as well as the ability of the receiving operator.

"When the transmitting operator decides as to the number of times he will repeat each word of the message, care should be taken to send steadily and to space properly. The transmitting operator should be particularly careful to see that each repetition is made in identically the same manner as not to confuse the receiving operator with different signals. It should also be borne in mind that superfluous signals, while always detrimental to efficient operation, are especially hindering during static conditions and they should therefore be eliminated."

The question of fast and slow sending has frequently been discussed, and I believe the general opinion is that comparatively fast sending—say about eighteen or twenty words a minute when each word is repeated—produces the best results, if static is intermittent and signals are good. Too many clicks occur in each word sent slowly, whereas it is possible to get nearly the whole word if sent somewhat rapidly and repeated. If the static is continuous the operator should always send slowly. It is possible to receive through weak static without repeating, if a low rate of speed is employed in sending.

Figures should be spelled out when static is bad. On account of the similarity of figures and the short space of time required to make them, one or two loud clicks or "grinders" will knock them higher than a kite; therefore, in spelling them out, we are able to fill in one or two missing letters, thereby making reception more sure and speedy. Sending each word once, then repeating the whole message, does not improve matters; instead it is a valuable waste of time.

Short numerals are often easier to receive than long numerals. For instance, the figure 0 becomes confused with the figure 1, in static, owing to the similarity of the cipher and the numeral. The writer strongly advocates the use of the long dash for the figure 0, and greater use of the short numerals. Unless we do this we shall be handicapped when the time comes for trans-Atlantic work where they will be used considerably, if not exclusively.

When there are no atmospheric disturbances, speed is what we most desire, though it should always be accompanied by good sending. It is useless to think that an operator can "fall down" on a word and pass it by, for he will surely be asked to repeat the missing word. A little advice, given to me when I was learning telegraphy in a railroad station, comes to me now. An old operator in the Philadelphia Postal Telegraph-Cable office, one hundred and thirty miles distant, said when I tried to "burn him up" over the wire: "Take it easy, learn to send steady and space well before attempting speed!"

When good sending is combined with speed the operators in the coast stations should have no difficulty in handling messages as fast as over the ordinary land wires. There is nothing more exasperating than to have an operator drag along at a snail's pace when conditions are favorable and half a dozen ships are

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waiting to get their messages off. Operators of this caliber should be compelled to wait until all others have finished before they are permitted to send. It is not an infrequent occurrence to have operators dally along two or three minutes on one "manager" message when thirty seconds should be sufficient. "Manager" messages, not unlike train orders, are practically all of the same order and should be disposed of as rapidly as possible. It is folly to assume that the coast station men are not capable of receiving messages at a faster rate, for if it were not so the Company would soon weed them out. Why not employ a little more zest, therefore, when sending?

We would be astounded if confronted in writing with the useless work done during each twenty-four hours. A ship operator recently called NAN and NAM at short intervals for three hours; during one of our busiest hours he took it upon himself to send press to another ship for forty minutes without a break and without first having requested or obtained permission from the nearby coast station. During this time seven ships stood by waiting to send their massages to this station. It is estimated that during these three hours the offending operator took up more time than the coast station which handled about twenty-five messages. The sum of the ship operator's labors was only one message. Like many other operators he thought he was at liberty to call as often as he chose just as soon as the coast station acknowledged receipt of a message. Operators should realize that we cannot hear the ships calling while interference is taking place so close to us.

*(Sig)*

Another ship relayed a "manager" message to us and called a few minutes later, saying the office of origin wished the letter S omitted in the word shoals and the letter E changed to I in the captain's name in the signature. Such piddling is positively absurd. Neither the word "shoal" nor the signature is ever used when compiling position reports for the Marconi Press Agency. All superfluous words are omitted, merely advising as follows: "Noon Havana 365 Scotland." Or when reporting freight ships or other steamers having no regular port of entry a slight addition is made, thus: "7 pm Archbold Port-Arthur for Bayonne ninety SW Diamond." If some of the unnecessary words were cut out before sending "manager" messages there would be less difficulty in disposing of them through atmospheric disturbances and outside interference.

Messages have come to us like this: "Manager Marconi station Cape Hatteras, s.s. Springfield bound from New York to Galveston was *227* miles south southwest of Diamond Shoal Lightship at 6.50 p.m., July 18th, (signed) H. B. Woodland, master, s.s. Springfield. This message should have been transmitted in this manner: "Mgr WHA, Springfield New York for Galveston *227* SW Diamond 7 p.m., (signed) Woodland." The words "Marconi station" are useless in the address because every operator knows that Cape Hatteras is a Marconi station. One or two operators have adopted a form in which all prepositions are omitted. For instance "New York Galveston" in the text indicates the ship is bound from the former to the latter port. The word "commander" in the signature has come into general use and is easier to receive than many of the captains' names. However, this is a small matter because the names themselves are not used, as previously stated. Consequently the operator is seldom asked for a repetition of the signature in a message of this kind.

Operators have said to me, "We've got to send what the Old Man gives us." Why worry the skipper with details when he does not understand the situation and you are doing him full justice? The moral aspect is the same whether the ship or shore station operator eliminates the unnecessary words. You understand, of course, that these statements apply only to "manager" messages. In a through marconigram we must have proper authority to make any changes.

I have heard coast station operators remark that coil tests—QSA and QRU

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# QRU

—were a nuisance. Coil tests are necessary and should be made as often as required by law. It is gratifying to note that operators are confining such tests to inactive periods. QRU is employed somewhat frequently. It is all right on one-man ships and craft far distant, especially if there is considerable interference in the vicinity, but on vessels close to shore on which it is customary to maintain a constant watch it seems quite unnecessary. It is not amiss to say here that operators who are given to enjoying tete-a-tetes with passengers of the gentler sex should not reveal the fact with a QRU immediately after the conversations have ended.

Unnecessary communication has been a very troublesome factor in the service, resulting in reprimands for many operators. It usually occurs when those engaged in it believe that quiet prevails. In the meantime other ships call and are obliged to wait until the exchange of words ceases. Occurrences of this kind are fast becoming events of the past, however. Four or five years ago idle wirelessing was carried on to such an extent that it precipitated clashes with operators who had been waiting to transmit messages or failed to copy press news. For instance, a ship operator who had been offered a detail at the Cape Hatteras station in the days when the United Wireless Telegraph Company was active, was told to "talk it over" with the operator at that station when passing. I shudder to think of what would happen if the messages exchanged were repeated now—five years later. About all we hear at the present time are a few choppy words—some form of greeting for the most part—which will also be done away with in the near future. In fact the Marconi Company has forbidden its operators to engage in any idle exchange of words, even forbidding them from passing GM, GE, 73, etc.

Some of you, when in the middle of a message, may have heard an operator break in, calling CQ or QST and say, "QRA starboard side," giving ships call letters several times, soon followed by "QRA starboard side here s.s. Nicholas bound from Petrograd to Berlin." If you have you will never do so yourself; if you have not, please have compassion on us and refrain from doing so.

It is with a feeling of misgiving, in view of the government examination, that I use the word inefficient in connection with the work of some operators, so perhaps inexperience would be more appropriate, except in a few rare cases involving bad sending and spacing which might be remedied with a little practice and forethought. Making the letter V for the figure 4, adding an extra dot to the figure 3 thus confusing it with the figure 2; jerky sending, intermingling of words, running the street and house numbers together, omitting the full name of ship in office of origin, failure to put the state in parenthesis when not counted, stumbling over words and not repeating them, inserting a number of periods and omitting the double dash, proceeding with the message after the spark has gone bad and repeating words and figures in endless succession without spacing properly are a few of the irregularities in sending.

# V4 3

Calling the station a great number of times without making your own call letters often enough is another fault which should be avoided. About the time this was written a ship gave me two very long calls, but I could not catch the call letters. The third time the operator called WHA eighteen times, flashed MSG twice, then signed once. Failure to answer a ship is largely due to this cause. Calling a station is very much like calling a man's name in a crowd; it immediately attracts his attention.

There seems to be a general misinterpretation of the prefixes used in relayed messages. Four-fifths of the operators, including the coast stations, will relay a message and prefix it with an X to the

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office of destination. Prefixes are not only intended for abstracting, but as a guide to the receiving station in the use of proper message forms. It is because of the latter purpose that they are sent first. If the letter X is included in the prefix the receiving operator naturally reaches for the relay pad. In practice most operators will relay a message to a coast station and prefix it in just such a manner, compelling us to recopy some of them on different blanks.

A relayed message should be prefixed with an X to the ship that relays it, but the latter should omit it when forwarding to the office of destination. Thus an MSG originating from the s.s Caracas and relayed to Hatteras by the s.s. Lenape should be sent by the KDB as an XMSG to the KVL and the latter should forward it to WHA as an MSG. Coast stations must be treated as the office of destination for all "manager" messages and those intended for retransmission over the land wires. Such messages should be sent to the coast stations as ordinary messages regardless of how received. If desired the word Via may follow the name of the office of origin to indicate that it is a relayed message, but it is not essential.

## ~~OFM~~

The prefix OFM is used only by the naval stations and should be excluded; the letter S should then be used. Ships not equipped with the Marconi system and not caring to use our prefixes should use the word Radio, omitting the prefix, according to international rules. It does not matter what prefix is used by other systems; the rates are not affected. As a matter of convenience, however, we prefer them to use the prefixes P, S and A, as the case may be.

There are a few operators who are unfamiliar with the form used in sending messages. Several weeks ago an operator sent us a message, placing a period at the end of each word; he also omitted the double dash which separates the address from the text and the text from the signature. I can see no excuse for this lack of knowledge; the operator should have learned the form by listening while others were working the form.

There is also a noticeable lack of knowledge in handling of service messages. When a message is received at a coast station for a ship that has passed beyond that zone, the office of origin is serviced in this manner: "Undelivered unable to communicate yours date Johnson s.s. Mexico signed Father, ship may be reached via Tampa Fla if you resend, we cancel and file." The message is marked cancelled and entered accordingly on the report. If the ship does not pass within the range of any other station the message is held for several days and special efforts are made to relay it or deliver direct should the atmospheric conditions prove favorable at night. In the meantime the sender is notified that efforts are being made to reach the ship and that he will be advised later. If the vessel is due in the station zone two or three days later the message is given to some other ship bound in the opposite direction and delivery confirmed after direct communication has been established.

When a message is received for a passenger who is not on board, a service message should be sent addresed to the office of origin, *not the coast station*, thus: "Undeld party not aboard yrs Williams sined same (sig) S.S. Hamblin."

If the addressee does not understand any part of the message, a paid service message should be sent to the office of origin, thus: "Repeat fourth text word not understood yours dated 9th Lambert sined Perkins."

Some of the principal abbreviated terms used in service mesages are: SYS, see your service; SFS, see former service; DFS, disregard former service; NSN, no such number; GSA, give some address; GBA, give better address; and HA, hurry answer. Service messages should be short and to the point. In other words, say all that is necessary in as few words as possible. When an operator wishes to rectify a mistake in a message it is always a good policy to put it in service form, not only comply with the rule prohibiting conversation, but to

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clear the operator from neglect or error should it come before the Claim Department.

This reminds me of an instance that occurred several months ago. A service message was sent to a ship advising that a certain message was undelivered because the person to whom it was addressed had moved, and his present address was unknown; whereupon the operator informed me that the sender wished his money refunded, asking if it would be all right to do so. He was promptly informed that all claims must be made to our claim agent in New York. The only time an operator is permitted to refund the money is when for any reason he is unable to communicate with the coast station direct or by relay prior to docking, or when he has held the message so long that the sender regards it of no further importance and wishes to cancel it.

The Marconi Company charges only for services rendered. It wishes to please its patrons and favor them whenever circumstances will permit, but after a message has been properly transmitted it has no further responsibility in the matter.

For the information of those who are not thoroughly posted, it should be stated that on all cablegrams sent via Hatteras there is an additional charge of one cent per word—ten word minimum—to be added to the Virginia state rate given in the tariff book. On all W. U. Frank messages there is also a charge of one cent per word, ten word minimum.

Counting of words seems to be exceedingly difficult for some operators. It is evident that they do not refer to the examples given on page 47 of the General Order Book issued by the Marconi Company and page 116 of the Handbook of Regulations, issued in 1913 by the Naval Radio Service. It is hoped that operators not entirely familiar with the counting of words will make careful study of pages 111 to 116 inclusive in the last named book.

The words "ck off" are usually given to the sending station when the count does not agree. It does not necessarily imply that the sending station is wrong for it is possible that the receiving station has missed a word. "Letter" is an invitation to transmit the first letter of each word counting and is a quick method used to locate the missing word. In such words as "New York," where the sender is permitted to forward it as either one or two words in the text, only the letter N should be lettered if counted as one word. In a group of figures give only the first figure of the group counted as one word.

When it is not possible to "letter" with any degree of satisfaction during bad atmospherics it is suggested that a word like "unite" be used as an invitation to unite and transmit the number of words in each of the component parts—for instance "adds 6 text 13 sig 2." This plan has been followed to some extent; except in present practice it usually follows in the nature of a request for the number of words in each, i.e., "how many ws in adds, text and sig?"

There are a few abbreviations in general use, not included on the two large cards issued by the Naval Radio Service, with which many of the operators are not familiar. They have proven a great saving of time and should be learned by all. WA, word after; WB, word before; AA, all after; AB, all before. Preceding these the repeat signal . . - - - is usually given. It will thus be seen that these signals used with the repeat signal made three times for a repetition of the whole message and inserted between two words, thus: "will . . - - - morning," asking for all between these two words, cover any and all parts of the message to be repeated without loss of time, or unnecessary words on the part of the sending or receiving operator.

It appears like a useless proceeding to make the ship and station call letters several times before giving the invitation to transmit. The letter K should be sufficient except in the case of ships at long range. Some ignore, mostly from doubt, while others readily respond to this short method. If more than one ship calls, the letter K is preceded by the call letters of the ship with which the land station de-

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sires to communicate first, thus: "KVS K." When the letter K is unaccompanied by call letters the ship calling may assume it is for him and proceed to dispose of his business.

To set at rest any doubt on the part of the sending operator, his call letters are usually given once either with K or at the finish with the letter R. .

Wireless communication, like the English language, was founded on words that best describe its meaning; therefore the introduction of new words and letters cannot be considered excessive indulgence of liberty when by so doing the entire service is put on a more progressive basis. As every philologer knows, Webster, in his compilation of a dictionary, adopted many terms of common expression in preference to more intricate words; thus we have a great number of idioms in present day use.

With the advancement of science, words and phrases become obsolete as new ones, that more adequately describe the nature of the work, are supplied. While most of the abbreviations and convention signals ratified by the Berlin Convention are in general use, some of them are giving away to better methods of communication.

In conclusion I wish to state that "logging" your fellow workers is not a pleasant task, but anyone who has witnessed the marvelous changes brought about during the last two years can appreciate its value to our employers and to ourselves. It is a duty rightfully imposed upon us and one that we should not hesitate to fulfill. Some (not many) operators take it as a personal affront. On one occasion an operator was "logged" for a lengthy conversation, but being under the control of another system he believed it was malice on the part of the station operator and threatened to write to all the operators of his line in an endeavor to prejudice them against the coast station man. He was a splendid fellow by nature, and as soon as the situation was made plain to him he immediately changed his attitude.

We sincerely hope you do not look upon us as informers. We are not malicious; we are merely performing our duty. We regret being obliged to "log" operators derelict in their duties, but we cannot allow sympathy to stand in the way of business. This matter was discussed recently with the traffic manager, and he assured me that every operator will receive due consideration and be dealt with as leniently as the circumstances permit, although it is necessary to take proper steps to safeguard and improve the service.

I am convinced that if we exercise care and thought we shall have little trouble in the future.

## TUCKERTON PRIVATE MESSAGE SERVICE INTERRUPTED

Announcement was made on August 31 that the wireless station at Tuckerton, N. J., will not accept private messages until further notice. All wireless messages for Germany and Austria, it was said, must be forwarded by way of Sayville, the rates for which are the same as those at the Tuckerton plant.

"If messages are held by the censors for explanation of the text, the published rates for messages from the censors to the sender and also for the reply must be charged to the sender. Only government or embassy messages can be handled via the Tuckerton station," the announcement adds.

Officials at Washington said the decision not to accept private or commercial messages at the Tuckerton wireless station was made necessary by the installation of new machinery, but that the interruption in service will be only temporary. Official messages will continue to be sent.

## SAGAPONACK STATION CLOSED

The Sagaponack station of the Marconi Wireless Telegraph Company of America (call letters WSK) has been temporarily discontinued and, until further notice, traffic will be handled by the coast stations at Sea Gate (WSE) and Siasconset (WSC) in place of the Sagaponack station.

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# The Man Who Directs The Nation's Wireless

**Interesting Facts Regarding Captain Bullard Whose Activities as Superintendent of the United States Radio Service Have Brought Him in the Public Eye**

*Captain W. H. G. Bullard*

CAPTAIN W. H. G. BULLARD, U. S. N., superintendent of the United States Radio Service, frequently in the public eye because of his many official activities, which included the taking over of the Sayville station for the United States, was born December 6, 1866, in Media, Delaware County, Pennsylvania. In his boyhood he attended the public schools in that place, being graduated from the high school at the age of fifteen. In the summer of 1882 he won an appointment to the United States Naval Academy after a competitive examination and entered that institution in September, 1882. Four years later he was graduated No. 3 in his class and began a term of two years' sea service preliminary to final graduation before promotion to the lowest grade of commissioned personnel, ensign.

After promotion to this grade he was detailed to duty on the Coast Survey, serving on both coasts of the continent. Sea duty and shore duty alternated and the various grades were passed through until July 1, 1912, when he reached the grade of captain. During this time he saw service in most parts of the world, spending one full term of sea duty in South America and South Africa, and another in the Asiatic station and the Philippines. He also took several sea voyages in the home or Atlantic fleet.

Ambitious to specialize in some particular branch, he began the study of electricity, which he continued to keep up. His first shore duty was in the Electrical Bureau of the Navy Department. The greater part of his shore duty was spent at the Naval Academy, where for four terms he was in the department of physics and chemistry and the department of electrical engineering. He was assigned in July, 1907, to organize the department of electrical engineering, being the first head of that department. He served in this office for four years. Recognizing the need for a text book on electricity for the special use of midshipmen, he prepared the "Hand Book for Naval Electricians." This book, which was merged into the "Naval Electrician's Text Book," has undergone three revisions and enlargements. It is now



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the standard text book at the Naval Academy for the use of midshipmen in their electrical course. A special laboratory was established under the charge of Captain Bullard. This has grown until it is now used for all kinds of electrical testing and experimenting.

Captain Bullard early identified himself with wireless telegraphy and has devoted particular study to the art since 1899. The Navy Department established the Radio Service in November, 1912, to supervise the government work, and it now includes more than 250 vessels and more than fifty shore stations. Captain Bullard is the first superintendent of the Service. In accordance with the law, certain naval stations are required to handle commercial traffic. The details resulting from this business, including the accounting and auditing, are performed in Captain Bullard's office. International accounting, as required by the London Radiotelegraphic Convention, is also performed in his office.

Captain Bullard was married in 1899 to Ellen Beirne Saunders, daughter of John S. Saunders, of Baltimore, Md. He has one son who is an assistant naval constructor in the United States Navy.

## A ROMANCE OF LETTERS AND JEWELS

A New York newspaper relates that Walter Condon, Marconi wireless operator on the steamship Minnehaha, recently came into possession of a woman's handbag containing much jewelry, a few keys, some money and a scandal. It descended upon him as he stood at Fifth avenue and Fourteenth street like some favor of the Caliph in the Arabian Nights, flung from a passing automobile in which five women were quarreling. And then he went to sea with the treasure, including the letters, the blazing, incriminating letters.

"Would have left all in New York if it were not for the nature of the letters," he writes, using the pilot as a postman. The "all" includes keys to vaults, a sum of money, a pearl necklace and three diamond rings, the accoutrements and symbols of a fortune guarded against reclamation by a hissing dragon of scandal coiled all about them.

Condon promises to muzzle the dragon. "The lady missing the same (the handbag, not the dragon) can rest assured," he continues, "that the contents of the letters will not be divulged by me to any one, and if the steamship Minnehaha is met on her next arrival in New York by any one who can fully describe the contents of the bag I will surrender it at once."

But perhaps the lady who flung the thing to the unexpectant multitude at the street corner hoped she was casting her secret, weighted down with jewelry, into an ocean whose waters would close over it forever. And now, like Jonah, it is to return from the depths. Will she welcome it? Will her four quarrelsome companions welcome it also and at the same time? Will Condon escape from the mêlée uninjured? Is honesty the best policy?

## WIRELESS HELPS NAVAL OFFICERS

Because of wireless telegraphy the officers of the United States Navy are not compelled to exercise as much initiative as they did in previous years.

The following dispatch was recently sent by Secretary of the Navy Daniels to all commanding officers of the navy:

"Due to the ease with which the Navy Department can be communicated with from all parts of the world, no commander-in-chief, divisional commander, or commanding officer, shall issue an ultimatum to the representative of any foreign government or demand the performance of any service from any such representative that must be executed within a limited time without first communicating with the Navy Department, except in case where such action is necessary to save life."

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# The Wreck of the A. W. Perry

**By L. F. Whitehead, Marconi Operator**

ONCE in a while a wreck occurs of which the public hears nothing. I took part in just such a marine mishap, an experience which I will not soon forget.

Four months have elapsed and little or nothing has crept into print about the wreck of the steamship A. W. Perry, so, ill-equipped as I am for the task, I expect it is up to me to guide my unskillful pen as best I can to the end that one more instance of summoning aid by wireless may be recorded.

The Perry was a Plant liner, had a long and serviceable record under her former name, the Byerly, a well-known passenger steamer operated by the United Fruit Company. In the service of the Plant Line she was running between Boston, Halifax and Prince Edward Island. Owing to the scarcity of Canadian operators ever since the war began, I was assigned to this vessel by the American Marconi Company at the request of its affiliated Canadian company. H. D. Phillips, the second operator, who accompanied me, was an American also.

We left Boston on Sunday, June 6, bound for Halifax. We had been given to understand that this was the last trip to that port, as the vessel had been sold to Mexicon interests and was to proceed to New York to be turned over to them.

Sunday was foggy, so was Monday and also Tuesday; I don't remember much about Wednesday. We were in one of those fogs which are so thick that all one can expect to see is the dock in Boston receding and the dock in Halifax approaching. To add to our enjoyment it was one of those "off" voyages when nothing goes right. We left with a record cargo of freight and everything and everyone disagreeing; and so we continued; not one of the crew seemed to sleep at any time, no matter what the hour; the same faces were seen about the deck, even when the men were supposedly off watch.

Thus had time dragged along when on Tuesday at two in the morning I came off watch and Operator Phillips went on. We were proceeding then at reduced speed, trying to pick up Sambro Light Ship. I hadn't slept since noon of the previous Sunday and after about two hours on deck I turned in with most of my clothes on. At 4:45 a. m. there was a crash and a bump. Instantly, I was wide awake and sitting bolt upright; I could hear things tumbling about in the wireless room. . . .

Just as it began to dawn on me what had happened, Phillips came tearing in shouting, "Come quick, we are on the rocks!"

He then stood by at the bridge.

In about five minutes Captain Ellis passed the word to Phillips and the S O S signals went flying. The first station to answer was the Camperdown, N. S., Naval station, acknowledgments being quickly received from the U. S. S. Miami and the Canadian Coast Guard Service ship Premier. The Miami was twenty-four hours away and could not help us, but the others sent encouraging replies.

Tugs dispatched to the scene by telephone from Camperdown arrived in good season, but at the first attempt we saw it was hopeless to expect them to move the Perry. Meanwhile the forty-two passengers had been taken off by a wrecking boat in a manner not particularly graceful, but certainly agreeable.

At noon the steamer was leaking badly; at four in the afternoon the forward hold was flooded and water was



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rushing in the passageways. The vessel had an ominous list to port and as the wireless room was on that side we watched the water creeping up to the boat deck apprehensively.

The water cut off our power at noon, but I used the coil steadily until 5 p. m., when we were ordered out on deck to stand ready. Preparations were then being made to attempt pulling the vessel off the rocks at full tide.

This attempt proved not only a failure, but caused the ship to shake and pound and list worse than ever. We experienced three hours of suspense while four powerful boats pulled at the lines on our stern. At any moment we expected they might get the ship clear from the rocks, in which case it was very doubtful that she would right herself. Those hours of suspense and the sight of the cruel, grim pinnacles of rock rising as high as the flying bridge of the ship, will stand out in my memory for many a day to come.

Eventually, however, we were ordered to leave the ship—which in itself was some job—and landed safely on a tug boat.

The next morning we thought it possible that some of the wireless apparatus might be taken off; we found, however, that we could not get aboard. Then, as the boats stood waiting around, the Perry was seen to slip down stern first, rock back again, tilt again stern first, and go down. Each time she took a dive the water forced the air out and the cargo shot out of the ports. The roof of the cabin next came off. Great quantities of ashes and soot from the stokehold followed. When she had gone it seemed as if the vessel had been a human being struggling and fighting to the last.

Not a very thrilling story, as I tell it. Nor is the event which it reports written high in the annals of the sea. A good ship was lost. No one won undying fame for heroism. It was just a wreck.

But wireless summoning the tugs made the safety of all possible. And that alone means a great deal to me.

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## MARCONI SETS ON MORE STANDARD OIL CRAFT

German-owned Telefunken wireless apparatus removed from twenty-two ships of the Standard Oil Company of New Jersey is to be replaced by American equipment, under the terms of a contract closed on September 23 with the Marconi Wireless Telegraph Company of America. The agreement runs for a period of years and the consideration is announced as sufficiently large to be considered the most important transaction in marine wireless telegraphy since the Marconi interests took over the equipments of the United Wireless Telegraph Company in 1912.

At the Marconi offices in New York City it was stated that the ships to be equipped have all been admitted to American registry under the Act of August 18, 1914, and formerly sailed under the German flag. Negotiations have been pending for some time to place the Marconi system throughout the Standard Oil fleet, but the deal could not be consummated while the vessels were under German registry. The contract signed with the New Jersey corporation brings the total of Standard Oil ships equipped to date up to forty-seven. Control of operators, international accounting of message tolls and inspection and maintenance of equipment will be assumed by the Marconi Company under the provisions of its rental policy; coast tax charged for messages to stations along the American coast will also be saved by the Standard Oil fleet.

The following are the twenty-two ships which will be equipped with Marconi apparatus: Ardmore, Baton Rouge, Bayway, Bradford, Brindilla, Caddo, Corning, Cushing, Dayton, De Soto, Moreni, Motano, Muskogee, Petrolite, Pioneer, Polarine, Princeton, Sumerset, Matinicock, Standard, Communipaw, and Glenpool.

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# Running the Blockade

**By J. Edward Jones**

HOW would you like to turn in with the thought that at any moment you may be awakened and assisted to leave the ship—perhaps somewhat disconnected—by the explosion of 500 pounds of gun-cotton at the water-line? Well, that is the mental picture with which we who are running the submarine blockade are frequently confronted.

I was a wireless operator on the American liner Philadelphia before the declaration of war; in fact, I was in London at that eventful time. We sailed the following day from Southampton, experiencing great difficulty in passing throught the mines in the Solent. However we got safely away after being stopped by a French torpedo-boat destroyer which gave chase. Since that time we have been running to the port of Liverpool, the Philadelphia being the first American ship to pass through the war zone as declared by Germany on February 18, 1915. It must be exciting, some people say. Exciting? Yes, for a while at least, but the excitement soon gives way under the suspense. It excites many to sing. Not ragtime, but "Will You Meet Me at the River," "Nearer, My God to Thee," "Where the Surges Cease to Roll" and other similar selections.

Many little incidents occur on war time voyages that are really interesting to travelers and those who have a thorough knowledge of conditions at sea at the present time, but as they would not be appreciated by the majority of persons, they will not be told of in this narrative. I can truthfully say that the operators are now quite accustomed to war time conditions, in fact, some of the circumstances born of the new order of things have grown somewhat monotonous. On one occasion, for instance, when we were still 900 miles west of Ireland, a woman passenger asked me "Shall we be torpedoed?" This question was followed by "Are there any submarines around us now?" It is needless to say that I could not answer these questions satisfactorily.

Personally I do not consider a voyage through the war zone more hazardous than crossing the remainder of the Atlantic, but it is obvious that others do not share my views. As the ship approaches the war zone measures are taken to pacify the passengers, and perhaps some of the crew. Rumors of dangers to come which, almost without exception, are baseless, are denied, and life-preservers are distributed throughout the vessel, all of the voyagers being instructed in the adjustment of these buoyant vests. The latter are placed so as to be accessible to every person on board. I have heard passengers remark that upon awakening during the night while in the vicinity of the war zone, they have found relief from nervousness by leaving their berths and trying on life-belts.

The life-boats are swung over the side, and hang in the davits ready to be lowered at a moment's notice. Although the emergency for which the boats are actually prepared would not, speaking generally from similar occurrences of the past, necessitate a long stay in the water, yet they are provisioned to meet any requirements of the passengers as well as the law.

On each side of the vessel the words, American Line, are painted in immense letters, six feet high, and just under this is painted, in letters of the same dimension, the name Philadelphia. An American flag flies forward, and the usual small flag aft is replaced by one eighteen



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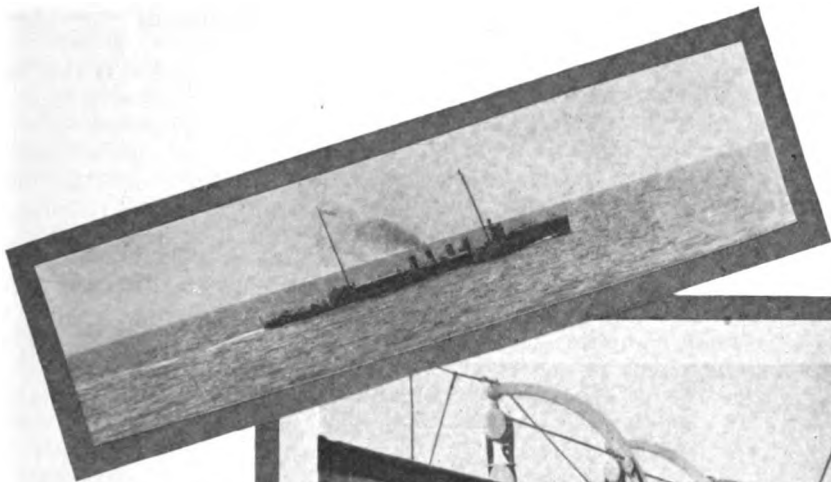
feet in length. There could hardly be an excuse, therefore, for mistaking the Philadelphia for a vessel of a belligerent nation. It has been said that a submarine cannot operate in the dark, that it is blind and has a few other drawbacks, so in order to insure protection for those on the American Liner other precautions are taken. At night six clusters of electric lights are placed in such a position that they bring into prominence the name of the ship and the steamship line; an American flag is also placed in the bright glare of these lights. Two clusters of lights, containing six bulbs each, are placed aft in order to illuminat the eighteen-foot flag. These lights produce a striking effect which is greatly admired by the passengers, some of them apparently believing that the illumination is for the purpose of decoration instead of protection. The extra display of lights undoubtedly conveys an emphatic "Do not touch me," to those for whom the warning is intended.



*"Shall we be torpedoed?" is the uppermost thought of some persons*

*When a steamship is in the submarine zone the lifeboats are ready to be lowered on short notice. Life-preservers are distributed throughout the vessel, all of the voyagers being instructed in the adjustment of these buoyant vests*

While passing through the war zone the sight of a small barrel may cause a rush to the rail to see a supposed submarine. One man who believed he had sighted an underwaters craft voiced the fact loudly. Followed a commotion which only ended when it was found that the "submarine" was a trawler. A peculiar coincidence occurred on the St. Paul, on which Mr. Marconi left America to respond to the war call of the Italian Government. Steaming on her way from Liverpool to New York, the Philadelphia met the St. Paul on the day before the latter entered the war zone, all our passengers knowing, of course, when we passed her. The rumor that she was being chased by a submarine because Mr. Marconi was on board, circulated about the Philadelphia, the report becoming so persistent that an officer of the ship visited the wireless room to inquire concerning the gossip. I was greatly surprised on my arrival in New York to learn that the same rumor was current in that city, notwithstanding the fact that

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no word of it had passed from ship to shore or vice versa.

A rather stirring incident happened—or rather we expected it to happen—on one of our recent voyages. We left New York, July 3, and on the night of July 6 we received information from Washington that a bomb, timed to explode on the seventh, had been placed on a ship that left New York bound for England on the third—in all probability the Philadelphia. Now this was something new in the form of sea perils. As we were in mid ocean and there were few ships about, we thought our days, yes, even our hours and minutes, numbered.

I came on watch at fifteen minutes to eleven o'clock at night, eastern Standard time, just after the message had been received. It requires but little imagination, therefore, to realize my feelings as I watched the hands of the clock slowly approach midnight, the beginning of the seventh, listening and waiting during those morning hours for that which I had no desire to hear. A thorough search of the ship was made in an effort to make sure that we did not carry a bomb, the ominous ticking of a quantity of alarm clocks in the ship's cargo adding thrills to the task. The contents of the marconigram were not revealed to anyone on board with the exception of a few of the ship's officers. During this time, we in the wireless cabin expected to hear of an explosion working havoc on some other ship. The ether remained at rest, however, and it was not until after our arrival in England that we learned that a bomb had exploded on the Atlantic transport liner Minnehaha. It caused little damage.

The reader will observe that this article deals for the most part with expectation which in war experiences is in every way preferable to realization. However, there are pleasanter thoughts than those of a little machine which is relentlessly ticking off your last minutes under the deck which holds you, and I can think of more enjoyable ways of employing my time than watching for that thin white line which marks the wake of a torpedo.

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# War Incidents

APPEALS for aid were flashed by means of Marconi wireless when the White Star Liner Arabic, bound from Liverpool to New York, was torpedoed by a German submarine off Fastnet on the morning of August 19. The vessel was sunk, but the majority of the passengers took to the boats and were picked up by passing vessels. Forty-four persons lost their lives as a result of the attack.

One of the operators on the Arabic, a newspaper dispatch from London says, was Leonard Batchelor. He was twenty-one years old and was taking his first voyage on the liner. He was formerly call boy at a theater and Cyril Maude, who became interested in him, gave him several small parts to play. Afterwards, through the good offices of Mr. Maude, he entered the wireless field.

Among the survivors of the Arabic was J. Edward Usher, a wireless operator, who was on his way to San Francisco to take a detail on a Pacific oil tank steamship. A dispatch from London says that he talked as follows regarding the sinking of the Arabic:

"When we left Liverpool the thing I noticed was that the life-boats were swinging out and that each one had jugs of water and biscuits in it. Also that life-belts were lying on the edge of the decks so as to be handy for passengers if anything happened.

"There was the utmost confidence among the passengers to whom I talked on the first day out, not one seeming to think that there was really any danger of being torpedoed. Being a wireless operator I made myself acquainted with the operators on the ship and they assured me that it was a 100 to 1 shot against our being submarined.

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"On Wednesday morning about half past nine o'clock, after breakfast, I went to the promenade deck and sat writing, when suddenly a woman sitting in the chair next to me cried: 'There's a submarine!' The next instant, before I had a chance to get out of the chair, came a terrific jar and it seemed as if the ship was keeling over. At the same time there was an awful roar. The woman next me scrambled up and that's the last I saw of her until at Queenstown when she was standing on the quay.

"After the torpedo struck I ran across the deck to the port side, the torpedo striking us on the starboard side, and began helping women into the boats swinging over the side.

"The amazing thing about it all was that, while many men and women were making for the boats, there was not the slightest uproar and not a sound of excited voices. All seemed bent on getting into the boats as fast as they could and without losing their heads. The crew aided tremendously in getting the passengers into the boats, making sure that they had life-belts and telling every one that they had plenty of chance to escape safely. I must say that I never in my life expected to see a crew so calmly going about their work in such a time, and never thought to see passengers in the face of death be so cool.

"The boats were so accurately handled by the crew that after the passengers got in them there was not the slightest hitch in dropping them to the water. It seemed as if all the passengers must be getting out as all the boats seemed loaded at once.

"As the boats dropped to the sea the Arabic began dipping down, stern first, until as the last boat reached the water, the bow of the liner suddenly leaped straight up into the air. I looked up and saw Captain Finch standing on the bridge. His face was calm and pale, as if he were facing death with the grim resolve not to desert his post. The next moment, as the Arabic plunged with a sizzing roar into the water, I lost sight of the captain. He went down far into the water, into the vortex of the sinking vessel, and the next time I saw him he was on the deck of one of the cruisers that rescued us.

"In the boat I was in were some thirty others, among whom was Stella Carroll, the singer, and her husband.

"When the boats struck the water we became aware of a severe, heavy sea. The waves were not high, but quite choppy, and the boats rolled like corks. As we started to row away from the sinking Arabic we saw two boats drawn down by suction. The passengers in those boats and also at the point where the torpedo struck were probably the ones who lost their lives. Those inside the ship at the point of contact were probably killed instantly.

"There was not a strip of land in sight when the Arabic sank. We rowed around for an hour and a half before we sighted a cruiser. Another cruiser came to the rescue, taking all passengers aboard."

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Marconi wireless telegraphy was employed to summon aid to the Allan Line steamship Hesperian, bound from Liverpool to Montreal, when she was attacked by a German submarine about 150 miles west of Queenstown on the night of September 4. The vessel was not sunk, however, and according to newspaper reports, there was little or no life loss.

When the Hesperian was struck, the wireless, according to a passenger, was put out of action. It was quickly repaired, however, and appeals for succor were flashed across the waters. The passengers and crew were ordered into the lifeboats and picked up by the vessels which had been called by the S O S. The Marconi operators were among the last to leave the ship.

The wireless log of the American Line steamship Philadelphia tells a graphic story of the attack. It says that at twenty minutes to nine o'clock on the night of September 4th the "Hesperian sends out S O S. Reports has been torpedoed and sinking. Sent position to bridge. Getting our position. MSN (Hesperian) says: Hurry!" At four minutes after nine o'clock the log records: "ZAAW (patrol boat) now tells MSN (Hesperian) that he is thirty-five miles off and asks if MSN has any passengers aboard. MSN says: "O. K. About 500 passengers aboard." Five minutes afterwards the Hesperian

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asked the Philadelphia at what speed the latter was going. The Philadelphia replied: "About sixteen knots." At nineteen minutes after nine o'clock the following marconigram was sent from the Hesperian: "Think everyone has abandoned ship except captain and selves. Lights all burning and rockets being sent up."

This cheering message was sent by ZAAW three minutes afterwards: "Will be there in half an hour and have hot coffee, etc., for 500." A few minutes later the Hesperian said: "Torpedo struck forward and she seems to be slowly going down." In the meantime there was still considerable anxiety on the Hesperian, notwithstanding the fact that wireless communication had been established with other ships, for MSN said: "Have told the captain to send up another rocket." Soon after eleven o'clock the patrol boat told the Hesperian: "Coming nearer to you now." At five minutes after midnight the work of rescue had evidently been completed, the Hesperian sending the following message to the Philadelphia: "Your assistance not needed."

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Fears were felt for the safety of the Fabre Line steamship Sant' Anna following the receipt of a Marconi wireless message at the Cape Race station on September 12 saying that the vessel was on fire. An official report to Washington later revealed that there were a number of bomb explosions on the vessel. The Sant' Anna steamed from New York for Naples with almost 2,000 Italian reservists on board. The marconigram telling of her peril follows:

"Steamer Sant' Anna in distress, on fire and in need of assistance. Position: Latitude, 40.23 north; longitude, 47.30 west."

This position is nearly in mid-ocean and is in one path of trans-Atlantic liners.

The wireless was used again, this time to give reassurance regarding the safety of the vessel, the following marconigram being received in New York on September 13, from Captain Pavy, the commander of the Sant' Anna:

"Fire in hold No. 2. Fire is now out. Proceeding to Azores escorted by Ancona. PAVY."

The State Department in Washington received advices regarding the fire on the Sant' Anna from Walter H. Schultz, the American consul at St. Michael's, Azores. He reported that when the vessel arrived at Ponta Delgada she brought the news that on Sunday, September 12, at midnight, fire was discovered in hold No. 2, which was filled with general merchandise and baggage. Eighteen fuses—as the bombs are called in the State Department's dispatch—were found and there were a number of explosions.

The Sant' Anna was 1,100 miles east of Halifax when the fire was discovered. The Ancona came to the rescue and the fire was extinguished. The Sant' Anna then proceeded to the Azores, escorted by the Ancona.

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As an indication of the demand made by the British Navy for wireless operators, it is reported that up to the present 5,250 Marconi operators have gone into the navy. Among those serving on warships one has earned the Victoria Cross, one the Cross of the Legion of Honor and four the Distinguished Conduct medals.

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## TUFTS COLLEGE TOWER FALLS

The new wireless telegraph tower at Tufts College, 304 feet in height, was blown over during a gale on September 26, and fell a few feet in front of an express train from Concord, N. H., on the Boston & Maine Railroad. The locomotive was derailed when it plunged into the steel framework, but no one was injured.

Passengers in a trolley car also had a narrow escape. The car was approaching the tower when the motorman, glancing upward, saw it swaying, and brought the car to a standstill within 100 feet of the falling steel. The breaking of a temporary guy wire as the structure swayed in the wind is believed to have led to the accident.

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# A National Association Promised

## Leading Scientists in the Field of Radio Communication Purpose to Combine Efforts for the Development of the Art

CAREFUL investigation into the conditions surrounding the remarkable growth in numbers and importance of amateur wireless workers is to result in the creation of a great national association, if the plans of the most prominent men in the field of radio communication are carried through as promised.

Details of this important undertaking have not yet been fully disclosed, but it is understood that the famous inventor, Marconi, is to head the organization, and among the array of American experts on the executive staff will be Professors Goldsmith and Kennelly. Instruction in the latest developments of the art will be furnished regularly to all members, and, under the present plans, all American amateurs of good standing will be eligible to membership. Existing clubs and associations may later be taken in on a co-operative basis and special discounts on purchases of club material arranged for through national headquarters.

The association will have for its primary purpose the promotion of experiment under capable direction. It will offer a medium for interchange of ideas and experiences and act in an advisory capacity in the conduct of tests that will enable new workers to progress to more interesting fields. Every encouragement will be held out to novices desirous of devoting a lifetime to the end of definite scientific achievement and as progress warrants it, members will be recommended for admission to prominent engineering societies.

With the support of the leading scientists in America, the association is assured of success and will fill a long felt want in the development of experimental work in a new but vastly important field. It has been recognized for some time that only through coordination of effort between clubs and individuals will the differences between conflicting commercial and experimental interests be adjusted. Through the acquisition of a national voice the new association will be in a position to state clearly and authoritatively the sentiments of the amateurs as a whole, without disturbing the identity of existing clubs and associations of limited spheres of activity. It is understood that every effort will be made to promote the welfare of these smaller bodies and special facilities for their individual development will be made available by the national council.

A formal announcement of the formation of the organization is promised in time for the November issue of THE WIRELESS AGE, and from the character of the preliminary details already disclosed this magazine feels it imperative that every established amateur call the attention of friends new in the field to the importance of the coming announcement. For the first time in wireless—or any other art or science, for that matter—the humble seeker for truth will be given the opportunity of absorbing at first hand the teachings and counsel of the world's greatest scientists and receive full recognition of whatever attainments qualify him for consideration in the world of scientific research.



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## TUCKERTON SUIT HEARING DESPITE THE WAR

Vice-Chancellor Stevens has filed an opinion in the Court of Chancery in Trenton, N. J., in which he concludes to hear the suit instituted by a French corporation against corporations of Germany to compel compliance with a contract entered into for the sale of the wireless station at Tuckerton. The vice-chancellor holds that if a suit could be heard in times of peace it could be heard in time of war.

An application was filed by the German companies seeking to have the New Jersey courts kept from taking cognizance because of the existing circumstances, that Germany is at war with France and that to enforce the contract at this time would cut off the only means of communication between the German Empire and the United States. The bill for specific performance was filed by Compagnie Universelle de Telegraphie et de Telephonie Sans Fil against the United States Service Corporation and the Hoch Frequenz-Mackinen Aktiengesellschaft Fuer Drahtlose Telegraphie of Berlin, Germany, which is referred to in the litigation under the abbreviated name "Homag," while the French Company is known under the designation "Cutt."

After holding that the present controversy concerns title to land in New Jersey and is a subject over which New Jersey courts have almost exclusive control, the vice-chancellor said:

"In times of peace the courts take jurisdiction as a matter of course for the benefit of denizens and aliens alike. If foreign nations are at war among themselves, this nation does not cease to be friendly. Its courts remain open to their subjects. Certainly a French citizen may still sue an American citizen. Why should he not sue a German subject? No law of France prohibits it. On the contrary, he may sue even France, if to his advantage and not to the advantage of his enemy. Why may he not sue in the court?

"If he may not, it can only be on the grounds that this court will give some effect to German legislation enacted as a war measure—as a means of crippling its enemies. As I have already shown there is nothing in this legislation, disclosed at least by the plea, that prohibits the German subjects from defending against a French claim. But suppose there were. If this court gave effect to it, it would, in a measure, be enforcing German laws, which, on well settled principles, can have no extra-territorial operation to the detriment of the French citizens asking to be heard. This, it seems to me, would be an unneutral act. I therefore think that the plea should be overruled and that the defendants who have not disclaimed should answer."

Under the contract entered into between the French and Prussian corporations, it was agreed that certain patents of invention for the production of high frequency currents specially intended for wireless telegraphy, together with the Tuckerton radio station, should be transferred to the French corporation. The consideration under the agreement was to be 2,500,000 francs and 50,000 founders' shares in the French company.

It is alleged by the complainants that the time has come to carry out this contract, but that because of the war the Germans refused to live up to its terms. "Homag" asserts that the Tuckerton station can communicate only with the German station at Eilvese, and that to give possesssion of the station to the French at this time would be to prevent Germany from communicating directly with the United States.

Speaking of the latter contention, the vice-chancellor said that this objection seems to be met in the plea that the Navy Department of the United States has exclusive control of the station, which is being operated under the supervision of a naval officer in charge, and that all tolls for messages are being collected by the government of the United States, which holds the station in trust.

Notice of an appeal from the vice-chancellor's order has been filed on behalf of the German company.

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A government wireless station will be erected at Coos Bay, Oregon, according to a San Francisco newspaper.

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# Out of the Static

## A Fiction Story

### By S. Ten Eyck Bourke and Charles Francis Bourke

In Which You Will Hear of a Fake S O S, a Fool Joke, and a Near Tragedy. A Queer Story of the Immutable Mystery of the Wireless

(*Copyright*)

IT was Blaney, the second operator of the Pandora, who picked out of the crackling static the report of icebergs in the path of her sister ship, the Pacific, then bound eastward on her voyage to Liverpool, and a hundred miles to the north of the Pandora's position.

It was a time and a season when the antics of the ice were turning the heads of the liner captains gray in a single passage, and ocean liners depended for their safety on the high-strung aerials of the wireless—slaves of the telegraph key, as the jinn of old were slaves of the lamp. Any moment a call might come, sending a vessel from her course full speed ahead to the succor of a sister ship.

The Pandora herself, the greatest of ocean steamships, swinging far down over the southern ship lane from Liverpool to New York, out of the zone of such dangers, had not escaped. For five days she had been boring into the heart of the spring equinox and fighting for every mile of her westward passage.

And for five days Blaney, the assistant wireless operator, and Hallowell, his newly appointed chief, who was making his first voyage on the Pandora, had been holding watch and watch in the white-walled wireless room. The men's nerves were on edge from the strain of the responsibility resting upon them, with the safety of the ship dependent on the touch of the telegraph key, and the voice of the vast void filtering into the receptors that the operator on watch wore clamped to his ears.

The myriad voices of the static had become an obsession that pursued them to their sleeping cabins, where, without undressing and sometimes forgetting the food that the stewards had laid out for them, they dropped into the sleep of utter exhaustion.

It was that, more than the steady hours, that was telling on them, though the two operators had been changing places every six hours, day and night, at the key.

It was no time for the human equation to fail or for men's personal feelings to interfere with the work of the wireless. Hermetically sealed against the storm, with a treasure in bullion in her strong room, and twice a thousand souls under her hatches, the Pandora, practically a huge, helpless steel hulk, trusting for eyes and ears to these two men, was racing to save her Royal Mail subsidy.

But trouble was brewing in the wireless room—trouble no man could foresee.

It did not help matters between the two operators that Hallowell, by some influence, had been promoted into the place left vacant when Cameron, former chief operator of the Pandora, was transferred to the Pacific, a place which by all the rules of the game should have been Blaney's.

The first sign of trouble came on the morning of the fifth day when Blaney picked up the message from the Pacific. The warning from the liner in the north came at noon, when he was waiting for Hallowell to relieve him and growling because the chief operator was taking his time about it.

"His lordship thinks he can pound his ear, when there's no glory to be gained—just hard work," Blaney growled.

In that place of crackling electrical devices, resentment had kept the two operators from exchanging any confidences; for the few moments that they met at the relief they confined themselves solely to business; the new chief asked no favors and Blaney offered none—and the message that he picked out of the ether, sent out, as it happened, by his old chief, Cameron, of the Pacific,



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revived all Blaney's bitter feelings.

It was all nerves, of course; but he couldn't help drawing a comparison between the two men.

"It would be just like luck to smash up old Cameron up there in the ice lanes, and leave dubs in good jobs that are not fit to handle a key with him," Blaney said, swinging around in his chair when he had sent the answering "O. K."

He had supposed he was addressing the remark solely to one of the Pandora's passengers, a young broker, who had struck up an acquaintance with him; but as he spoke, the chief operator came in through the inner bulkhead door. Hallowell had his own sleeping cabin.

He was a younger man than Blaney, but he knew how the assistant operator felt, and he merely picked up the report. Neither operator noticed that the visitor's curiosity led him to read over Hallowell's shoulder:

"s. s. Pacific, New York to Liverpool, one day out, sighting icebergs moving south, latitude 50, longitude 40.

"L. CAMERON, Opr."

"So that's her position?" Hallowell said, "only fifty, forty—a hundred miles north of us?"

"That's her position," Blaney answered sullenly, "and Cameron is not a man to repeat his messages. He always gets it over straight first time, ice or no ice, and lets it go at that. There isn't anything else to report."

That was all that passed between them, but the passenger, who knew he didn't belong there, saw how matters stood between the two operators.

He went out with Blaney when the latter clawed his way aft to his sleeping cabin on the deck below. It was blowing great guns. The Pandora, in spite of her great size, staggered as she sheared her way through the huge seas, parting the swells like a great edged knife. As they stood watching the welter of waters Blaney's resentment welled up anew.

"When old Cameron was aboard we didn't have to climb over the decks in weather like this," he said; "we could chin with each other over our own private system, just as well from down here as up above."

He was speaking to himself rather than to the passenger, but the other caught him up, following him into the little sleeping cabin.

"You mean you fellows had a way of communicating with each other?" he said. "A telegraph line, or something. I'd like to see that!"

Blaney was dead tired, and wanted to turn in, but it seemed the quickest way of getting rid of the man. From behind the bulkhead he pulled out a little telegraph instrument, merely a key and sounder, with connecting wires that ran back of the partition.

"It's just a cut-in wire," he explained. "Cameron and I used to have this cabin together, and he rigged it up; ran the wire in between the bulkheads, and connected it with the ship's aerials up on top of the wireless house.

"If it was a green lad up there now in the wireless room," Blaney chuckled, "he'd think he was getting a message right out of the ether. Only, as it happens, this wire isn't working now; it's cut off from the ship's wireless."

It struck him as a grim joke, nevertheless. It had never occurred to him to tell Hallowell, his new chief, about the little telegraph instrument—a man was not apt to swap confidences with another who had snapped up a job from him. But if he wanted to——

The young broker seemed to read what was passing in his mind.

"By jove!" he said; "you could fool a green operator with this thing. You could shoot a fake S O S up into her aerials when he was listening, and send a big bullion ship like this wheeling miles out of her way. It would mean big money to some speculators to do that," the passenger remarked. "How would you send a message of distress on this thing, anyway?"

If there was anything behind the other's eager acceptance of a "fake" call of distress, Blaney was too sleepy to notice it. It may have been only the possibilities of the thing that got into the young broker's blood.

Outside, the storm seemed to boom louder than ever. The shrieking of the wind and the lashing of the salt spray seemed to assault the great liner like live things, striving to batter her back, hoot-

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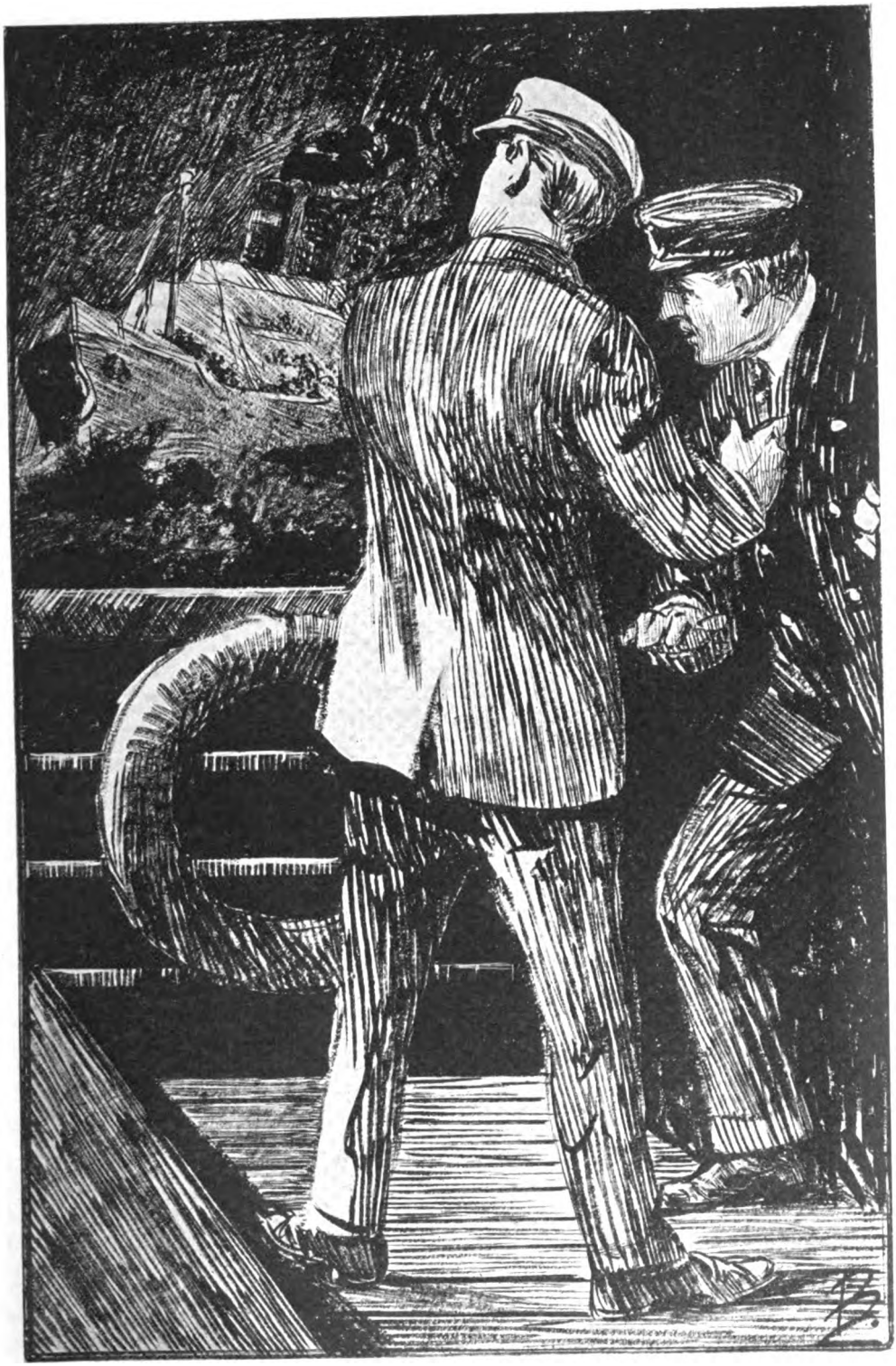

*Out of the murk loomed the Pacific, half swamped, her spars and aerials in a hopeless tangle, her bow splintered and smashed by the seas*



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ing at the puny efforts of officers crowded like bugs on the bridge.

The uproar shut out the sound of the spark that Hallowell, in the wireless room, was sending up into the aerials, then listening for a possible answer, and sending up his tentative call again. On the bridge, the watch, in dripping oilskins, clung on for dear life.

"The S O S message? Why, there's only one form for distress calls." Blaney was tapping mechanically on the little telegraph key. "This thing is cut off from the aerials now, of course," he interpolated. "Cameron himself disconnected the wires before he left the ship. Otherwise it would sound just like a wireless call up above."

He was wishing the passenger would go, but he was too tired himself to take the initiative. His practiced fingers clicked out the terrible call of a ship in travail, as he repeated it aloud:

"S O S. s. s. Pacific. Struck iceberg. Sinking. Latitude 50, longitude 40. Rush help. S O S. CAMERON, Opr."

The suggestion, so fresh in his mind from his friend's former message, sent the call clicking off from the key without his own volition. When he glanced up the face of the young broker had gone suddenly white, and he remembered himself, tossing aside the instrument.

"That's a kind of fool joke. Good thing it isn't connected up!" he said with a yawn.

He threw himself on his bunk, too tired to notice the passenger's departure; too dead beat even to touch the lunch that was set out for him. The tumult of ocean sounds passed him by—the pounding of the Pandora's great heart, the sudden thumping of sea boots, and the shouts of the officers, and the snarling, cracking whine of the wireless, like a struck harp string, leaping, blue-flamed, into the aerials and out into the immensity of the void.

Up in the white-walled wireless room, Hallowell, equally white, crouched over his spark-spitting instruments, searching vainly for a faint, little voice that had leaped, without warning, at him out of the ether—the call of a ship in distress in the icy sea—the steamship Pacific, that only a short time before had sent out her warning of ice in the northern lanes, and now lay sinking, a wreck, on the ocean.

Breathlessly Hallowell sent out his answering spark, calling on the Pacific to repeat—to confirm her S O S call.

"No other ship on the ocean seems to have heard it, and I can't raise him again," the chief told the hastily summoned commander. "But the call came from Cameron, on the Pacific, giving her position and all."

It was not customary for a ship to send up an S O S call, and then suddenly "die," even in such a storm as was raging. The officers in the white-walled room stood scowling, awaiting the captain's verdict, while Hallowell sent up his spark and sought over the length of his tuner to pick up some sound out of the miles of murky waters.

"The distance would be nothing to the Pacific, if she could work her set—five hundred miles would be the same as a hundred," the operator said; "but she's just quit, dead!"

To the experienced commander that fact sufficed; the earlier warning of ice that the Pacific had sent out confirmed the crackling summons from the static sufficiently for him. The old sailor's scent of danger leaped, like the wireless, over a hundred miles of storm to that other ship lying somewhere out on the spray-lashed ocean, a helpless wreck, or —since she did not send up her call again —plunging fathoms deep in the icy seas.

"She's sent for us, and we're going!" he said. "Maybe she's only smashed down her machinery, and maybe she's under brine, but——. Turn her head for the north, men, and push her! We'll stop for nothing. And you," he turned on the white-faced Hallowell, "keep on trying to raise her—send out no other messages of any kind."

The great Pandora, till then marking time, engineers at throttle, officers waiting the signal, leaped into life. From her aerials the blue flame of the wireless crackled and spit; her boilers foamed under forced draft, and, turning her lean bows to the north, with the following storm urging her on, she straightened into her stride regardless of obstacles or ice or the peril of death impending for her in her headlong dash.

The call of the wireless had sounded. For the Pandora there was nothing to do

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but obey—men, machinery, wireless. Only the voice of the Pacific could stop her, once she struck into her stride.

Blaney woke to a sudden realization of a change in the ship's motion, and a sense of trouble in the air that made him leap from his bunk and swing open the door of his cabin. A glance at the tumbling ocean showed him what he wanted to know.

"By George, she's changed her course," he said. "They're driving her straight into the north, with the sea after her. What's that for, I wonder?"

Next moment he knew. Over the boom of the sea and the shrieking of the storm in the rigging came the one sound for which there is no counterpart—the cracking snarl of the wireless spark in the aerials, calling on some ship to answer! Blaney read it off, his hair crisping:

"RR. Tell us where you are, Pacific. Got S O S and coming. RR. Pacific, for God's sake repeat."

"Good heaven!" he said. "Hallowell's heard from the Pacific—she's in trouble with that ice she warned about. That's what they're going north for!"

He snatched up his cap and sprang on deck—face to face with the young broker, who had followed him down to his cabin from the wireless room. The man thrust a crumpled paper at him, a wireless message form, Blaney noted at a glance.

"Here," the passenger said, "your partner won't send that for me to New York—you've got to do it."

Something in his tone, the emphasis on the last words, chilled Blaney with sudden remembrance of what had passed between them in the little cabin.

Had the private wire been connected, after all, when he tapped out that foolish message at this man's insistence? Was the other gambling on that chance, trading on Blaney's open resentment toward Hallowell to compass his own ends—jeopardizing every life aboard, and the great steel hulk herself, in this heedless dash into an ice-mined ocean?

The thing was too dreadful! Hallowell *had* picked up a message from the Pacific—she was in trouble. Hadn't Cameron already sent out one warning, and wouldn't she answer the Pandora's call if all was well with her?

As for this vermin with him—— His eyes blazing, Blaney swung on the passenger. "See here," he snarled, "you're trying to work some of your speculating games, because the ship's delayed—going to the succor of a ship in distress. I'll see you hanged first!"

"You're responsible for sending her," the other snarled back. "Dont you suppose I know the game you put up on that man upstairs? You send that message, *somehow,* or——"

"You're a fool!" Blaney said defiantly. "I'll tell the captain about it myself, if that's what you're thinking of."

He started to claw his way forward, staggering to the lurch of the speeding vessel. Suddenly it swept over him what confession meant. Not dismissal for himself alone, but what if the law of chance, which no man denies who dares old ocean, had turned an antic trick? The Pacific might have sent in a message, even if his own message had gone through; what responsibility was he taking upon himself in turning back the Pandora, when men might be dying up there in the north?

And now, for the first time, he was conscious of another sound, as he clung there, hesitating in the grip of a great fear, the fear of dooming his own ship to imminent disaster, the terror of turning succor from men facing certain death.

The sound grew in volume, rising above the snarl of the wireless—the animal cries of men in anger; stokers, fighting their way up from the engine room. Mutiny!

Blaney knew what mutiny in the fireroom meant. The overworked stokers were in fear of their own lives—lives that hung in the balance with all aboard while the Pandora forced her way through the gloom of the storm.

Running forward, he found himself in a jam of fighting, snarling men; firemen forcing their way out on deck, met by the officers with pistols and handspikes fighting them back. Before he knew it, he found himself in the thick of the mob, fighting side by side with the officers of the ship, dealing blows and taking them.

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With the fear in his own heart forcing him on, Blaney fought like a madman. Back and forth on the deck the men struggled. Then suddenly the tangled mass swarmed to the gangway. Panic-stricken, in face of the flaring pistols, the stokers fled like rats back to their hole. Quickly as it had arisen the mutiny melted away—and the great Pandora pounded on.

Blaney, with the fog of fight still on him, staggered forward till he fetched up at the bridge ladder. He would see what Hallowell was doing, anyway. Perhaps by now the Pacific had picked up the Pandora's insistent call; had answered. Then he would know——

Hallowell, crouching, white-faced, over his instruments in the wireless room, sending up his ceaseless cry to the Pacific, glanced up, to face a man as drawn and haggard as himself. For the first time since Blaney had been superseded his eyes, peering out of his bloodstained face, met the other man's without animosity. But there was a fear in them now, a fear that the chief operator could not understand.

Fumbling on Hallowell's desk for the record of that S O S call, Blaney listened as the other mechanically reported what he already knew. His own brain was in a tumult of doubt and anxiety.

It couldn't be, in face of the Pacific's continued silence, that it was his telegraph message that had misled Hallowell. Cameron had said he had disconnected the private wire from the aerials, and it wasn't like old Cameron to be mistaken about a thing like that. Besides, there was always the chance of the two messages coming in together. He clung to that hope. Stranger things had happened over the wireless.

He found that he was searching for, pounced on it—the Pacific's call of distress. Thank God, the report was not in the exact words he had sent—but a man, especially a new operator, might miss a word or two in receiving a call like that. The parallel was terribly close.

His mind was spinning in the deadly circle, torn between silence and confession, round and round. He knew himself to be on the breaking point—and then, the final blow fell.

Suddenly Hallowell's hand ceased rapping out the interminable call of the wireless. The hoarse roar of the Pandora's siren flared up, bellowing like a bull in the night, swelling in its bell-like blast in a roar of triumph as over some long-sought object, suddenly found. Then it died down, listening.

From the ocean, startlingly close aboard, same an answering siren's scream, fainter, but with the unmistakable note that thrilled men's hearts—the human cry of an insensate thing, that had surprise and joy in it, as of men who had been long gazing into the jaws of death and suddenly saw rescue in sight.

"By Jove, they've picked up a ship!" Hallowell cried.

Together, the chief and Blaney sprang to the door. Out of the murk ahead a shapeless hulk had loomed up, black of lights, save for a few firefly lanterns that gleamed palely, like battle lanterns in the squattering smoke and spume that covered her. A great liner!

The Pacific! Drunkenly rocking on the spray-lashed sea, half swamped, her spars and aerials in a hopeless tangle over her side, her funnels gone, and her bows splintered and smashed into shapelessness by the terrible impact of the ice—but unquestionably the lost liner—the Pacific!

"We've found her! She must have struck hard, from the looks—down by the head and her top works raked clean to the rail—but she's still afloat, and her people on her. Thank God, we got to her in time!"

Almost with the roar of her commander on the bridge, the Pandora's boats were racing for those splintered bows, regardless of the high seas, regardless of everything save to reach the black mass of passengers on the sinking ship, who wept and prayed and cheered on the rescuers they had never hoped to see.

"The Pacific!" Blaney stood, with dropped jaw, watching while the boats of the liners shot back and forth under the lee made by the giant Pandora—saving life while yet there was time. "Then she did send out that S O S call, after all!" Blaney said.

Hallowell stared at him, not understanding. "Why, who else sent it?" the chief said. "It didn't come out of the static by itself. Sure," the chief

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laughed, "she squeezed out one yell, I guess, just before she struck the ice and everything went by the board—And I got it. And there she is, and here we are, and here comes the last boat. There's the cap and the officers, and there's Cameron himself. Come on, Blaney, and greet the procession!"

"Thought we were gone for good when the wireless went!" the Pacific's captain said, as he came over the side. "How in Heaven's name did you happen along?"

"Why, you didn't think we were going to desert you, did you?" his brother commander returned. "We came wheeling for all we were worth the minute we got your S O S."

"Our S O S? Our—— Why, Heaven's name, man! Our aerial wires and spars went first crack when we struck! Operator Cameron couldn't get out an S O S if he wanted——"

"But he did!" Hallowell broke in. "And I got it. Blaney's got the record there—giving your position and telling what had happened, and signed by Operator Cameron. Who else could send it?" the chief repeated his question to Blaney. "It didn't come out of the static!"

"I never sent it," Cameron repeated. "God knows I tried to send up an S O S, but I didn't have time."

Bewildered, he stared at the record Blaney handed him. There it was, the S O S call, the Pacific's position, and her peril, and Operator Cameron's own signature.

Then the eyes of the Pacific's operator met his former assistant's.

Cameron remembered the little telegraph instrument in Blaney's cabin that they had both used so often to talk to each other by way of the Pandora's aerials, so the man on watch could listen to the telegraph and the wireless at the same time, and a strange suspicion, vague, unformed, leaped into the Pacific man's mind. Blaney read his glance, and nodded.

"But it couldn't have been that," the Pandora's assistant repeated doggedly. "That wire wasn't even connected up."

"That's where you're wrong," Cameron said slowly. "I meant to disconnect the wires, but I left the ship in a hurry. I forgot to cut it out."

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## MARCONI MAN WINS WIRELESS CONTEST

The wireless telegraph contest, one of the features of the telegraphers' tournament held in San Francisco in connection with the Panama-Pacific Exposition, took place on August 27 and was won by A. E. Gerhard of San Francisco, representing the Marconi Wireless Telegraph Company of America. J. L. McKinnon of Los Angeles won the toss for the choice of first transmission, sending thirty-one and a quarter words a minute, which Gerhard received. The latter retransmitted the same messages at the rate of thirty-two and a half words a minute, McKinnon receiving. Through an error the same messages transmitted by McKinnon were given to Gerhard for transmission. The judges decided that Gerhard excelled both in sending and receiving. The following acted as judges:

R. B. Woolverton, United States radio inspector in charge in San Francisco; V. Ford Greaves, United States radio engineer, Washington, D. C., and W. L. Stevenson, in charge of the electrical department of the Postal Telegraph-Cable Company in San Francisco.

The Carnegie diamond medal, representing the all-around telegraphic championship, was awarded to T. S. Brickhouse of San Francisco. Brickhouse also took first honors in the commercial contest for sending 60 messages. H. E. Barfield, of The Associated Press, San Francisco, was the winner in the receiving event. In sending the messages in this contest Brickhouse also established a new world's record.

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# The New Marconi Standard Equipments

A NEW type of commercial radio apparatus—the Marconi standard 2 k.w. 500 cycle panel set, the power being measured at the transformer primary terminals—has been designed by the Marconi Wireless Telegraph Company of America in order to meet the changing conditions in wireless. These include the great increase in radio traffic, the stricter requirements of the government and the development of the art which makes necessary the substitution of equipments from time to time. As a result of the rental policy which the Marconi Company maintains its patrons receive the benefits of the various improvements in wireless, this fact being attested by the large number of the new sets which the company is installing on coastwise vessesls.

Constructed to conform to the various conditions found on shipboard and with the view of simplifying the handling of the apparatus, the equipment gives increased facilities for transmitting and receiving the great volume of traffic which is met with in congested waters like those of New York Harbor and other ports. In the past, on ships where the wireless cabins were on passenger decks, voyagers frequently complained that they were unable to sleep while the apparatus was in operation. On vessels where the wireless cabin adjoined the quarters of the ship's officers, a similar complaint was made by the latter. The new panel set being of the noiseless quenched gap type, this objectionable feature is eliminated. It has, moreover, the high pitched penetrating musical note which is produced by high frequency apparatus and can be read through static when low frequency notes are unreadable.

The installation of the equipment is considerably simpler than any other type of set, all of the apparatus being mounted on the panel which occupies a minimum amount of space. This feature has a distinct advantage on coastwise craft where the problem of finding accommodations for wireless equipments is a vexed question because of the small size of the cabins on the majority of these vessels. It was impossible to install the earlier type of equipments in a uniform manner because the cabins vary in their dimensions, thereby making different arrangements necessary. Because of the panel feature there is only one way to install the new set. This affords the advantage of standardization, one of the most important essentials in any large industry, both from the viewpoint of operating efficiency and economics.

The telephone companies and other concerns realize the value of standardization and in wireless telegraphy it is perhaps more important than in any other industry. This is a truism for the reason that interchangeability of parts and familiarity with radio equipments by the various operators who are required to handle the same sets are the nucleus of reliable and efficient wireless communication. The efficiency of the operator naturally will be increased with the standardization of marine equipment because of the fact that with one set to learn and master he will become more familiar with the operation of the apparatus than if he



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were required to work various types of installations. Then, too, the discussions which take place among the operators concerning the operating details of the equipments, will enable each man to obtain the cumulative experience of his fellow-workers regarding the standard set.

Another noteworthy advantage of the new set is that its use makes more practical the transfer of operators from one vessel to another—changes which are frequently necessary. With all ships equipped with standard sets, the operators will not be compelled to spend time and effort in acquiring knowledge regarding how to operate the apparatus. Consequently they will render more efficient service.

A detailed description of the equipment is as follows:

The complete set consists of a transmitting and receiving apparatus and various switches and appliances for manipulating the equipment. The transmitter, which is of the panel type, has all of the regulating and manipulating appliances mounted on the front of the panel so that they are easily accessible. Means are provided so that three wavelengths—300 meters, 450 meters and 600 meters—can be transmitted, the change of wave-length being accomplished by throwing a switch to the desired position. The control of the switch adjusts all circuits so that the wave-length wanted can be transmitted immediately. This enables the operator to handle traffic with a minimum amount of interference when in congested zones.

On the front of the panel is mounted a wattmeter which indicates the amount of energy consumed at the terminals of the transformer; a radiation meter which indicates the current flow in the aerial circuit; a motor field rheostat which enables the speed of the motor-generator to be varied; a generator field rheostat which permits the variation of the generator voltage; an aerial inductance handle which permits the variation of inductance in the aerial circuit and indicates the amount in turns; a wave-length switch which permits the change of transmitted wave-lengths; a handle which permits the variation of coupling between the closed and aerial circuits, and a low power switch which permits transmission at extremely low power in order

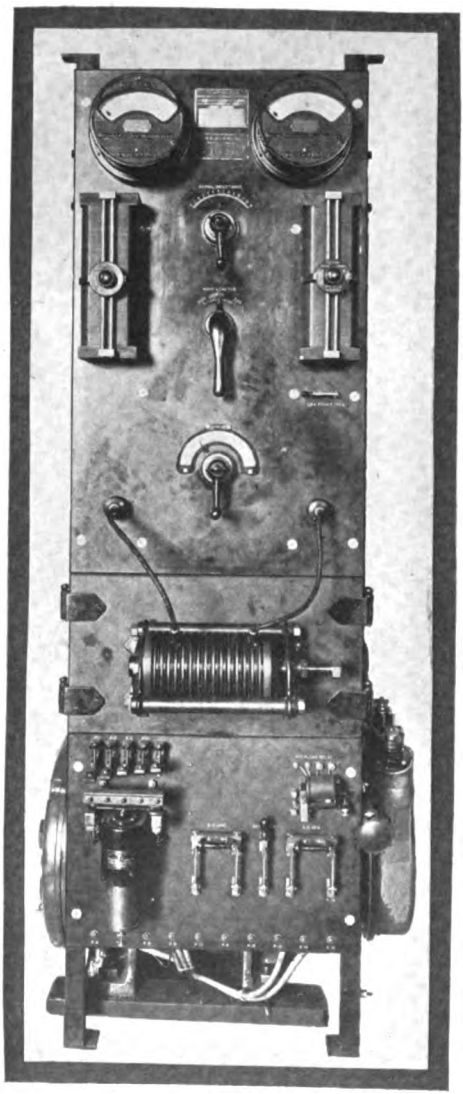

*Fig. 1—Front view of the complete transmitter in the new Marconi standard 2 k.w. 500 cycle panel set*

to reduce interference to a minimum. Beneath this panel is another panel which contains the quenched spark gap. The latter panel is mounted on hinges so that it can be opened from either side for the purpose of re-

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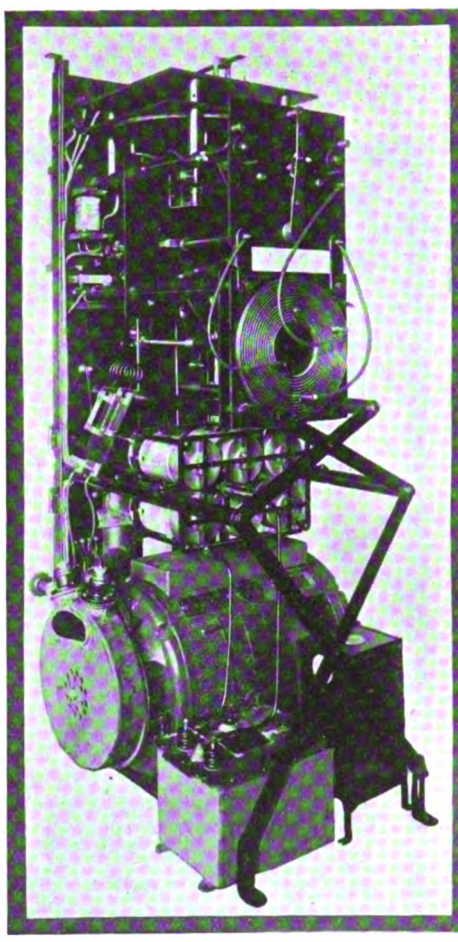

*Fig. 2—Side view of the 2 k.w. panel set*

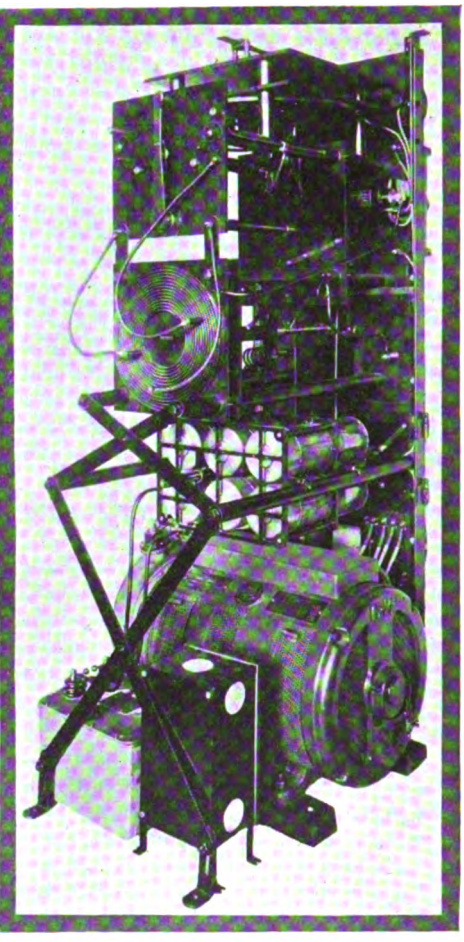

*Fig. 3—Back view of the equipment*

moving and replacing the condenser jars.

The quenched gap is cooled by an air blast delivered from the combined rotary gap and blower mounted on the end of the motor generator. Beneath the quenched spark gap is placed the starting panel on which are mounted, all the starting appliances, control switches and protective devices. A number of posts or lugs are also mounted on this panel, permitting the external connections to be made without difficulty. An automatic starter enables the motor to be started from a distant point by means of a single pole switch. The starter cuts out three steps of resistance when starting and energizes the generator field when the motor is up to full speed. This prevents the operation of the set until all resistance of the starter is cut out. When the control switch is opened the starter automatically connects a resistance across the motor armature terminals which quickly brings the motor generator to a stop.

The fields of the motor are connected to the line voltage until the D. C. switch is open. By means of this mechanism the motor can be started in ten seconds and stopped in approximately the same time. This enables the operator to stop his transmitting set quickly when receiving, an operation which is necessary when the received signals are faint. An over-load relay, which is mounted on the front of the starting panel, opens the motor circuit when an

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over-load or short-circuit occurs. The over-load relay is constructed so that it can be reset by opening the control switch in order that the motor generator, unless there is a permanent short-circuit on the line, may be started again as soon as the control switch is closed. There are no fuses or other protective devices in the A. C. circuit, as the characteristics of the generator are such that it can be short-circuited without an abnormal flow of current. A single-pole switch is mounted on the panel for the purpose of opening the generator field. A double-pole switch is provided which permits opening the generator circuit when desired.

*Fig. 4—Front view of the complete receiving set in the 2 k.w. panel equipment*

The motor-generator is especially constructed to operate under conditions on shipboard. The motor will operate at full load with practically constant speed on a voltage varying from 95 to 120. The generator is of the wound armature type, giving an open circuit voltage of approximately 350 and a working or load voltage of 140. The normal output of this machine is 2 k.w. wattmeter measurement. On top of the generator are mounted the devices which protect the machine from the excessive potentials developed, due to the close proximity of the high frequency circuits. An iron cover overspreads the protective devices and the machine terminals. The protective devices consist of six condensers, each of which have one terminal grounded to the motor generator frame, the other terminals being connected to a terminal of the motor-generator. The condensers have a capacity of such value that there can be no excessive rise of potential at the terminals of the motor-generator. The armature shaft is extended at the generator end to permit the mounting of the rotary spark gap. The latter is of the synchronous type and has the same number of spark terminals as the generator has poles. The stationary spark terminals permit a discharge to take place between them and the terminals carried on the rotor. A num-

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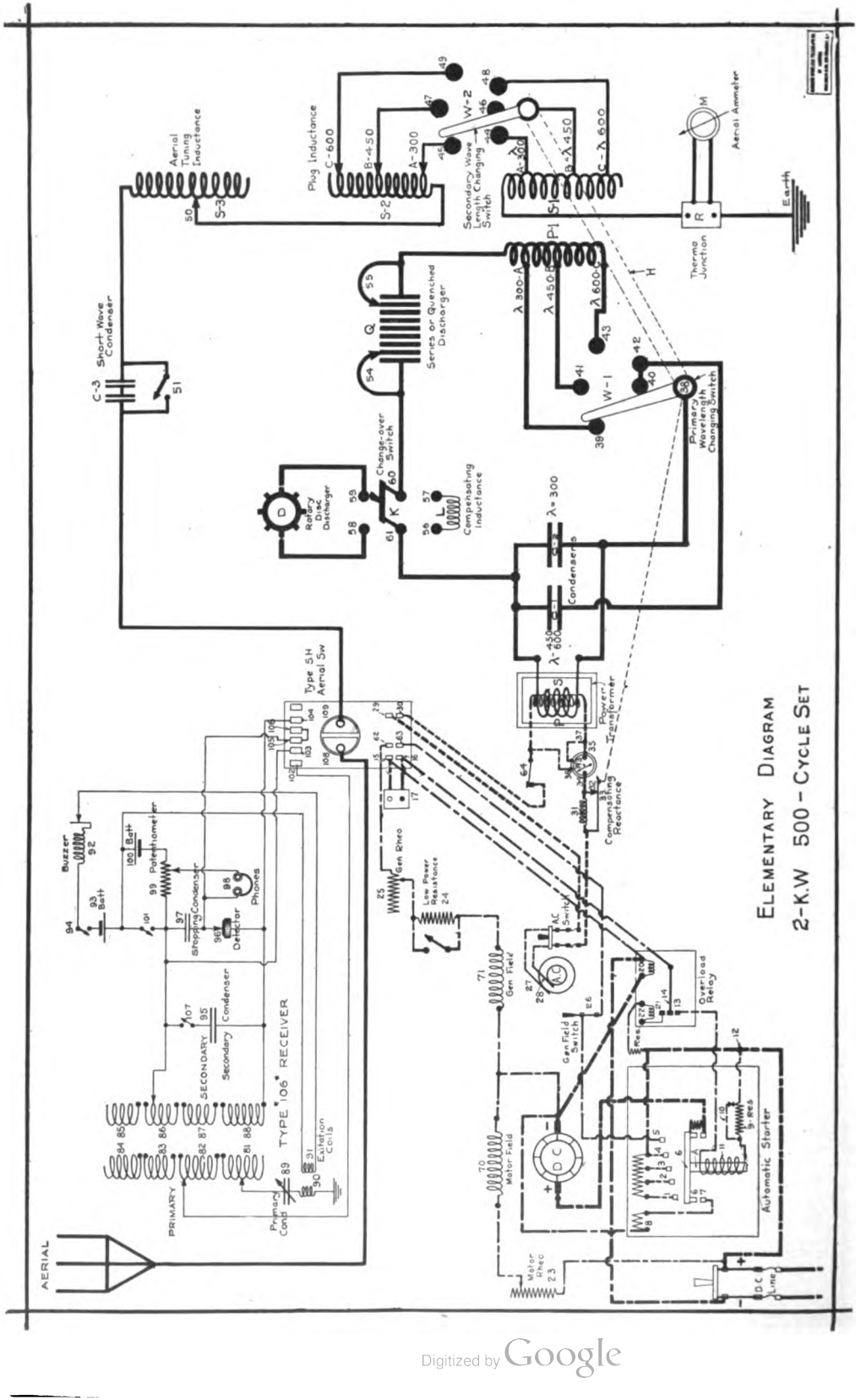


*Fig. 5—Diagram of connections of the complete 2 k.w. panel set*

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ber of blades are mounted on the rotor which acts as a pressure blower for furnishing air to the quenched gap, as well as ventilating the rotary gap itself. A cast iron case surrounds the rotor, a duct made of insulating material connecting the casing with the quenched gap. A portion of the casing carrying the stationary spark terminals is made rotateable for the purpose of adjusting the spark gap to the proper position for operating. This casing is rotated by means of a handle mounted on the side of the panel.

The transformer, which is of the closed core type, is enclosed in an iron case. The windings and core are supported from the cover of the transformer, together with the primary and secondary terminals. The windings are completely immersed in a transformer oil, which is solid at ordinary temperatures. A protective spark gap is provided at the terminals of the secondary which permits a discharge to the case of the transformer when the potentials become excessive. The case of the transformer is grounded.

The starting and stopping resistance units are mounted in a case which is installed on the floor of the operating room, back of the panel.

The motor-generator is mounted on the floor of the operating room back of the starting panel. The transformer and resistance units are mounted on the floor immediately back of the motor-generator. Connections between these appliances are made by means of lead covered cables to the starting panel. The cables are made up in groups of proper length, so that the set can readily be connected up.

Fig. 1 shows a front view of the complete transmitter; Fig. 2 a side view, and Fig. 3 a back view.

The elements of the high frequency circuits are mounted back of the transmitting panel and supported on insulating rods. The inductance coils are of spiral form and consist of a bakelite dilector slab having a spiral groove cut in one face. Into the spiral groove is fitted a strip of copper of the desired number of turns. This form of inductance has been found very convenient and economical from the standpoint of space. It also permits contact at any desired point on the spiral. The closed oscillating circuit consists of an inductance called the primary, a condenser consisting of six jars having a capacity of .002 microfarad each, the quenched spark gap, the rotary spark gap and the wave-length switch. All of these elements are connected in series. A switch permits either the rotary spark gap or the quenched gap to be connected in the circuit. The wave-changing switch is controlled by the handle on the front of the panel and, when in the 300-meter position, three jars, or half of the total capacity, are connected in the circuit. This was necessary, due to the fact that on this short wave-length and with the total capacity of .012 microfarad in the circuit, there would not be enough inductance used to permit the necessary coupling between the aerial circuit and the closed circuit. When operating on 300-meter wavelength only half power, or 1 k.w., can be used. A reactance is automatically connected in the circuit of the transformer primary which gives the proper working conditions for operating on this power. When the wave-length switch is set at 450 meters, six jars, or the total capacity of .012 microfarad, is inserted in the circuit, together with the proper amount of inductance. When set for 600 meters the total capacity and the proper amount of inductance are inserted in the circuit.

The aerial circuit consists of the antenna; the aerial inductance, which is varied by means of the handle on the front of the board; a loading inductance which permits contact to be made at any point, and another inductance called secondary. All of these elements are connected in series to the ground through the thermo junction of the radiation meter. The primary or the inductance of the closed circuit can have its distance from the secondary varied by means of a handle marked coupling. This permits varying the mutual inductance between the two circuits. A wave-length changing switch is also inserted in the aerial circuit which is controlled by the handle on the front of the board. The handle controls both the primary and secondary switches so that one operation not only connects in the proper amount of inductance and condenser in the closed oscillating circuit and the aerial circuit, but also permits the

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change of wave-length and still maintains the proper coupling between the two circuits without varying the distance between the primary and secondary. When operating on the quenched gap the distance between the primary and secondary is very short and is kept constant. In tuning up the sets, therefore, it is necessary to get the proper coupling between the two circuits by adjusting the correct amount of inductance in the secondary, at the same time providing the necessary inductance in the loading coil for obtaining the desired wave-length. The primary circuits are set for a definite wave-length, and in tuning the set it is not necessary to use a wave-meter.

Operation with the rotary gap requires a much looser coupling than with the quenched gap and when the former gap is used the coupling is adjusted to a considerably greater distance. The proper coupling for operating on this gap is determined by varying the handle until a maximum reading is observed in the aerial ammeter.

The receiving set is made up of a type 106 tuner with a crystal detector. The tuner consists essentially of a variable inductance which is placed in series with the antenna and the ground. This inductance is called primary. A small variable condenser is also in series with this circuit being used to shorten the natural period of the aerial so that signals of short wave-length can be received. When this condenser is not needed it is turned to the "off" position where it short-circuits itself. The closed circuit consists of a variable inductance and a variable condenser in series. The variable inductance is movable relative to the primary so that the coupling between the two circuits can be varied. In shunt to the variable condenser of the closed circuit is connected a potentiometer, with the detector and a condenser, all in series with each other. The telephones are connected in shunt to the last named condenser. A battery provides the necessary current for operating some types of crystals. Other types of crystals do not need this current; therefore a switch is provided by which the battery circuit can be opened or closed at will. A buzzer circuit is provided for testing the sensitive condition of the crystals. Provision is made not only for adjusting the capacity and inductance of these circuits to resonance with the received signal, but also for varying the ratio capacity to the inductance of the circuit while maintaining the same wave-length in the circuits. It has been found in practice that crystals operate best with a certain value of inductance in the circuit. Fig. 4 shows a front view of the complete receiving set.

An antenna switch, while in receiving position, throws the receiving circuits into operative condition and at the same time opens the primary circuit of the transformer and the generator field and stops the motor-generator. When the switch is thrown into transmitting position, the last named circuits are closed and the motor-generator is started. The receiving circuits are automatically short-circuited in order to protect them from the transmitter. A single-pole switch, when closed, keeps the motor-generator running continuously.

A key of special construction permits the opening and closing of the transformer circuit in accordance with the signals to be sent.

In some cases a series condenser, connected in series in the aerial circuit, is provided, being employed to shorten the natural period of the aerial in order that a 300-meter wave may be transmitted. The condenser is short-circuited when the other wave-lengths are employed. When the natural period of the aerial is below 250 meters it is not necessary to use the series condenser.

Fig. 5 shows a diagram of connections of the complete set. Great care was taken in designing the apparatus to provide a large factor of safety in order to do away with all causes of trouble. The equipment is complete in every detail and only a very short time is required to install it on shipboard. In the majority of installations a storage battery is used so that the set can be operated independent of the ship's power.

A ½ k.w. set, which is similar in all essentials to the 2 k.w. equipment, has also been designed by the Marconi Company. It is intended for use on smaller vessels and as an auxiliary set on large craft. As the generator, transformer and other appliances in the ½ k.w. set are of such weight as to permit mounting on the panel frame work, the transmitting apparatus is made in a complete unit.

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# IN THE SERVICE

The wireless equipments and the men who operate them have been written of in THE WIRELESS AGE at various times. Little has been said, however, of George W. Hayes, who, as superintendent of the factory of the Marconi Wireless Telegraph Company of America at Aldene, N. J., oversees the construction of the apparatus. Who he is and what he has done have a timely interest in view of the fact that the factory recently turned out a new type of commercial set, a description of which is published in this issue.

Hayes was born in Rexfords Flats, Saratoga County, New York, in October, 1884. He attended the grammar and high schools and the electrical night school in Schenectady, afterwards obtaining employment in the engineering department of the Schenectady Railway Company. His next step in the working world took him into the employ of the General Electric Company in Schenectady. During this time he showed his interest in wireless by conducting experiments in the art at his home. He remained in the employ of the General Electric Company for three years, leaving its service in October, 1907, to become assistant superintendent of a factory maintained by a wireless telegraph company in Jersey City.

When the Marconi Wireless Telegraph Company of America extended the field of its operations in 1912, Hayes was appointed superintendent of the factory at Aldene. Some idea of his responsibilities can be gained from the statement that practically all of the American wireless sets in commercial use are manufactured in the Aldene factory. In fact, the demand for apparatus has been so great that it has been necessary to keep the factory in operation both day and night for long periods.

In one part of the building are almost a hundred types and styles of various machines which are used to prepare the many parts of apparatus for the assembly departments. The task assigned to each man is checked up by means of a system which effectively guards against mistakes. Not less interesting than the machine shop is the precision department where the parts which call for minutely precise machining and very delicate handling are made. Exactness in every task is the keynote of the work in this department. The transformer department, the testing department and the electro-plating room should also be mentioned as features of the work connected with Hayes' activities. Protection against fire is afforded by two Marconi fire companies, fully equipped with apparatus to fight the flames. The efficiency of the members of the companies is increased by a drill which is held twice a month.

Notwithstanding the multitude of details born of his responsibilities, Hayes has found opportunity to cultivate a fad—photography. A large collection of photographs attests his skill with the camera.

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*The Marconi service has a particularly strong fascination for youths and young men. In this photograph are shown the members of the messengers' education class in Marconi House, London*

## HONGKONG WIRELESS SERVICE

After about six years of agitation and negotiation, including lively debates in the Hongkong Legislative Council and official communications between various governmental authorities concerned, the port of Hongkong finally has a wireless telegraph service with ships and coast stations within a radius of 500 to 700 miles in daytime and 1,300 miles and over at night in that part of the world. The wireless plant, which has been under construction for the past six months, under the supervision of an expert sent out from England, has been completed and placed in regular service by the government. The service is in charge of the post-office department of the colonial government, and the Hongkong post office handles the local business. Messsages are now received in the Hongkong post office. A charge of $3 local currency, or about $1.32 gold at present exchange, is a minimum for sending a message, this charge covering a 10-word radiogram. For each additional word a charge of $0.30 local currency, or 13.2 cents gold, is made, the address and signature being counted in the message in each case. These charges do not include the ship or receiving-station charges.

The wireless service thus inaugurated is from a well-equipped station erected in a most substantial manner. The service is independent of the military and naval wireless station erected on Stonecutters Island in Hongkong Harbor, which has been erected under the supervision of the same expert.

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# From and For those who help themselves

## Experimenters' Experiences.

*The editor of this department will give preferential attention to contributions from amateurs covering the design of transmitting sets, wave-meters, etc. There is an over-supply of material on receiving tuners, particularly "loose-couplers," the designs for the majority of which present nothing new or original.*

### FIRST PRIZE, TEN DOLLARS
### A Cabinet Receiving Set of the Panel Type

The receiving set about to be described is specifically designed for the reception of comparatively long wavelengths. Within the cabinet is combined an inductively-coupled receiving transformer, an aerial tuning inductance, an audion and a perikon detector with the associated appliances for obtaining conditions of sensitiveness. A feature of the set is the use of rotary movements for all the variable elements such as condensers, potentiometer switches, primary and secondary switches, etc. The coupling between the primary and secondary winding is likewise altered by a knob with a rotary movement mounted on the front of the box, as in Fig. 1.

A general view of the front elevation of the assembled apparatus is shown in Fig. 1, a corresponding diagram of connections in Fig. 2 and the details of the switch parts and crystal holders in Fig. 3. Fig. 4 shows a side elevation of the assembled apparatus with the panel removed, while Fig. 5 shows the dimensions of the various transformer parts.

The construction of the cabinet will first be considered. The following pieces, preferably of surfaced cherry, should be ordered: Base (one piece), 21 inches by 13 inches by 1 inch; top (one piece), 21 inches by 13 inches by ⅝ of an inch; back (one piece), 20 inches by 12 inches by ⅝ of an inch; ends (two pieces), 12 inches by 12 inches by ⅝ of an inch. As a support for the inductances of the primary winding and the antenna circuit two pieces are required which should have dimensions of 5 inches by 10 inches by ½ inch; for the secondary winding heads, two pieces, 4½ inches by 4½ inches by ¼ of an inch are required. To insure accuracy the four latter pieces should be taken to a cabinet shop for turning.

After the back corners of the cabinet are mitered all pieces should be drilled for binding-posts and screws just previous to the application of sandpaper. This completed, they should be rubbed with No. 00 sandpaper, followed by a coating of mahogany wood dye. When thoroughly dry the surface should be waxed and rubbed until a perfectly satisfactory polish is secured.

The front panel of the box may be either a piece of bakelite or hard rubber, 20 inches by 20 inches by ¼ of an inch. The dimensions for drilling of the panel are shown in Fig. 1. The necessary positions for taps, scales, and screws should be plainly marked, as per the drawing.

The places marked for taps are to be drilled out with a 3-16 inch auger bit followed by the drilling of holes for the


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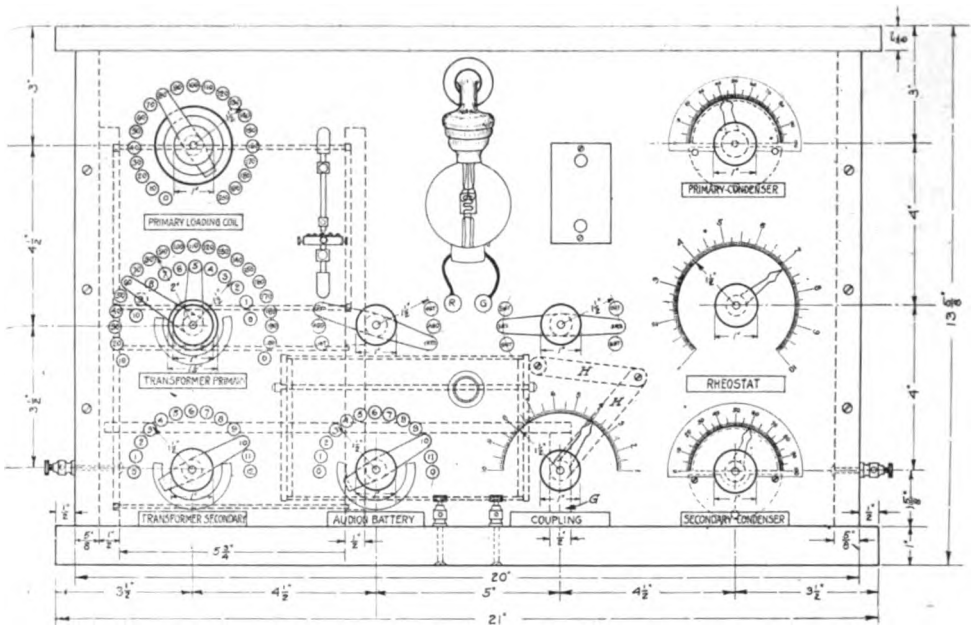


—FRONT ELEVATION.—

*Fig. 1, First Prize Article*

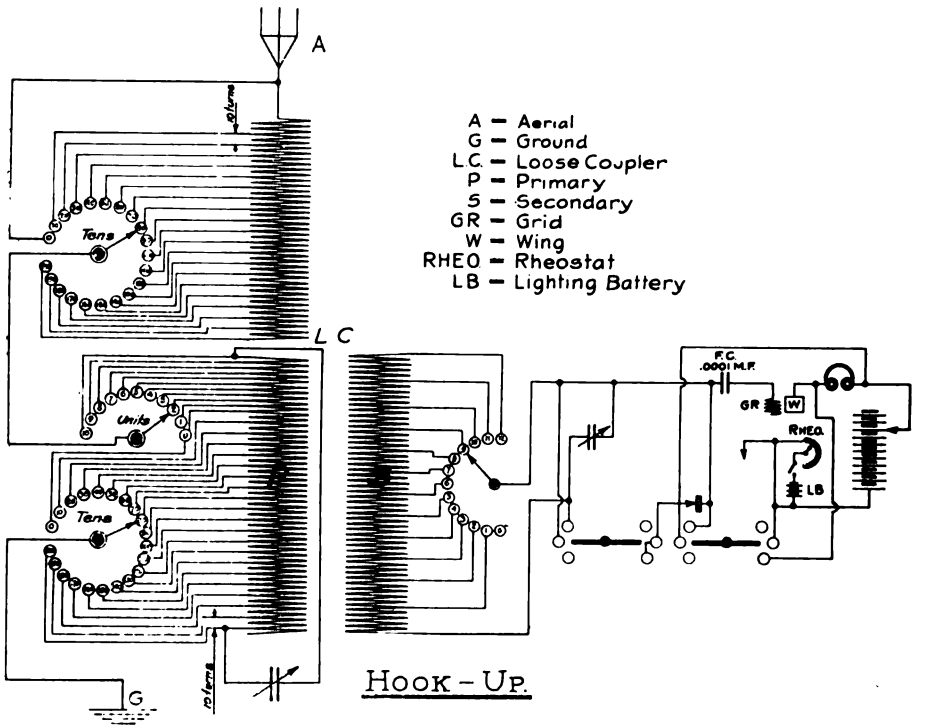


*Fig. 2, First Prize Article*

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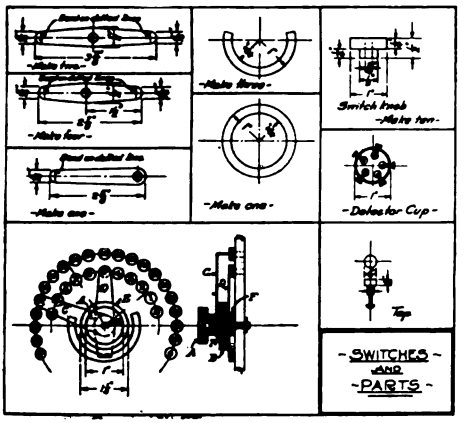


*Fig. 3, First Prize Article*

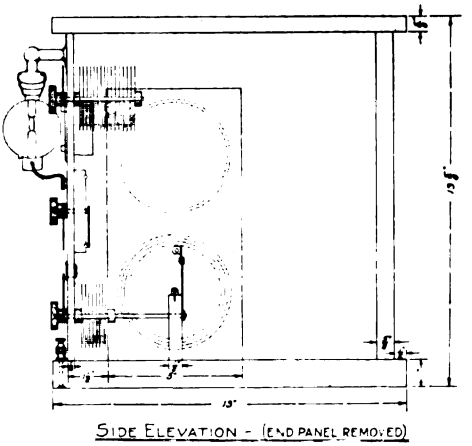


*Fig. 4, First Prize Article*

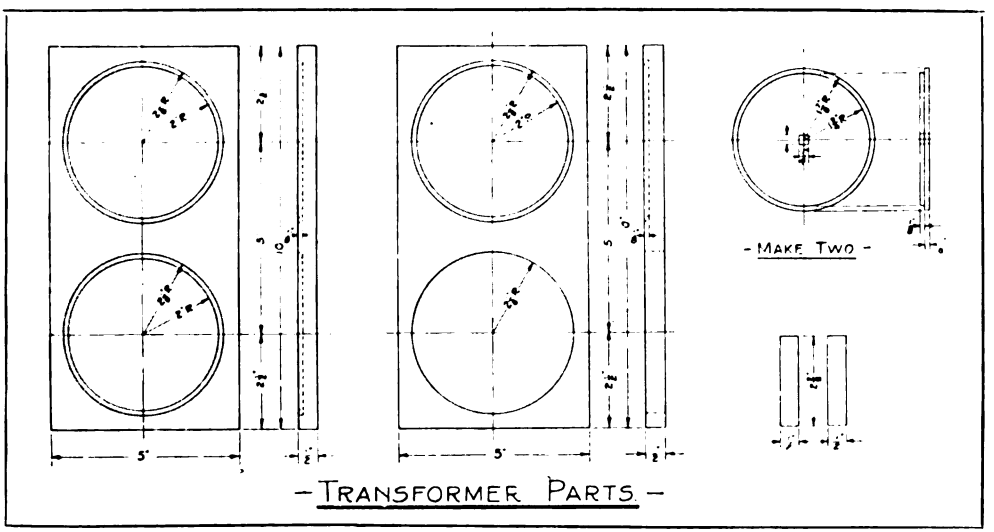


*Fig. 5, First Prize Article*

centers of all switches and screws. An oblong large enough for the insertion of a small push button switch is cut at the right of the audion at the right elevation, as shown in the drawing. The panel is now ready for the mounting of the fixtures, but it is a good plan to put the cabinet together in order to insure that all pieces fit properly. It is recommended that brass screws be used throughout.

The switches employed in this set are especially constructed. As will be observed from the drawing, the arms are bent over at the ends, insuring a perfect self-cleaning contact at all times. Connections to all switches are made by the use of brass sectors, thereby eliminating all possibility of the wires working loose. The construction of the switch parts is shown in Fig. 3. The switch plates are made of No. 20 gauge brass stock, while the switch knobs may be turned from pieces of hard rubber 1-inch in diameter by 8 or 10 inches in length. This material can generally be purchased from an electrical supply house. If a

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suitable lathe is not available the rods should be taken to a machine shop for turning. The construction should be clear from an examination of Fig. 3.

The switch taps are preferably of the following dimensions: Diameter of head, 5-16 of an inch; height of head, 3-16 of an inch; diameter of shank, 3-16 of an inch; height of shank, 5-16

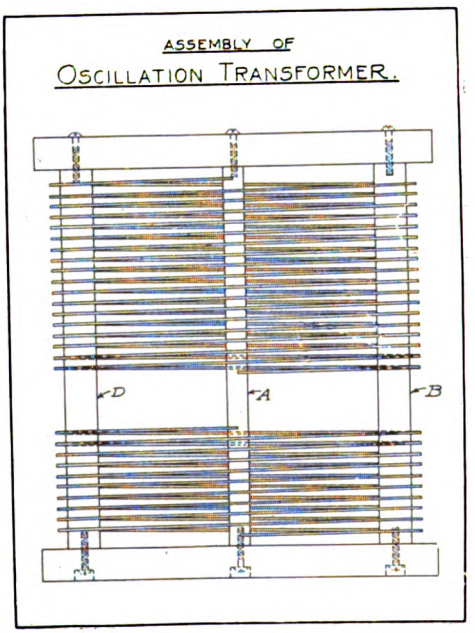


*Fig. 1, Second Prize Article*

of an inch. These taps should be fitted with machine screws. The numerals for the taps should be stamped on, as shown in the drawing of the front elevation.

The construction of the transformer primary switch will probably present the greatest difficulty to the builder. By reference to the diagram of parts (Fig. 3) it will be seen that A is the common switch knob mounted on the shaft, B. C and D are switch arms, while E is a large knob insulated from the shaft, B, and free to revolve around it. FF are brass washers. In this switch one connection is made to the shaft, B, and the other to the secondary.

The variable condenser should be mounted in the cabinet with the knobs, pointers, and scales protruding. The primary condenser is mounted in the upper right hand corner. To be effective it should have a fairly high value of capacity and should be con-

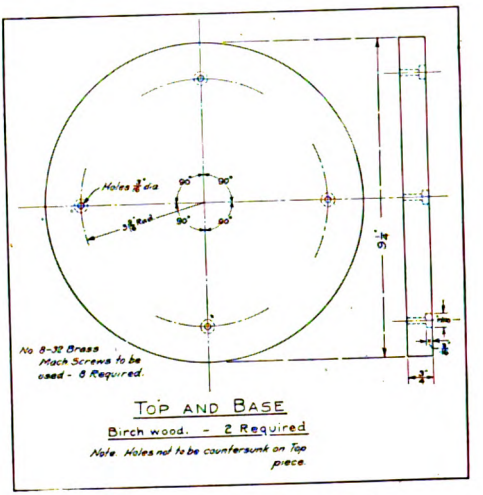


*Fig. 2, Second Prize Article*

nected in shunt to the primary winding of the receiving transformer. The secondary condenser, located in the right hand corner, is so arranged that by a rotary movement of the knob it

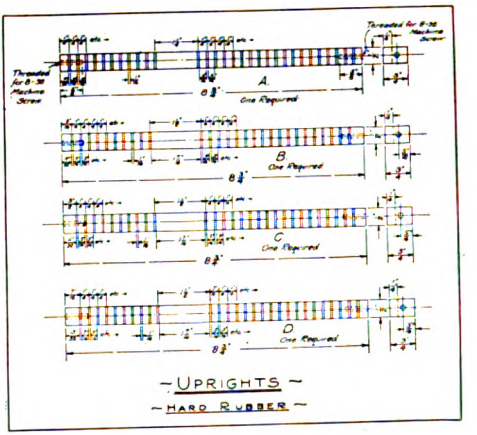


*Fig. 3, Second Prize Article*

can be connected either in series or in shunt with the secondary inductance (see diagram of connections, Fig. 2).

It is preferable to purchase condensers of this type from supply houses.

The receiving transformer and the aerial tuning inductance will now be

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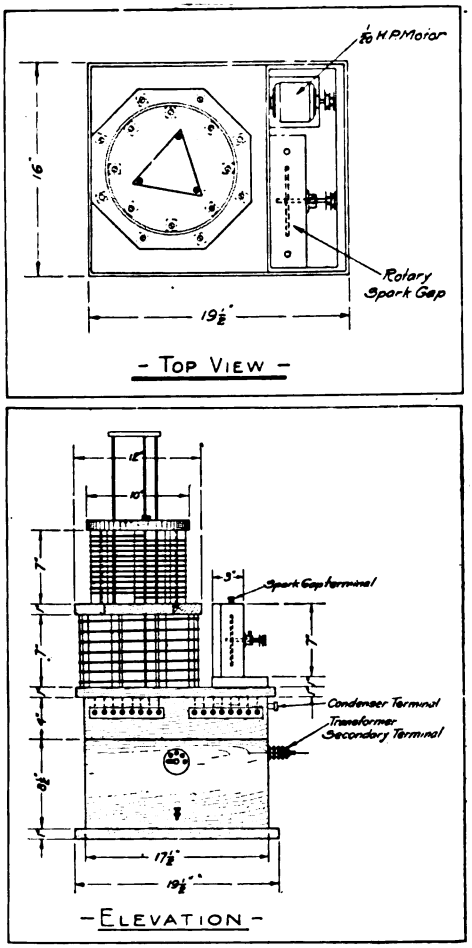


*Figs. 1 and 2, Third Prize Article*

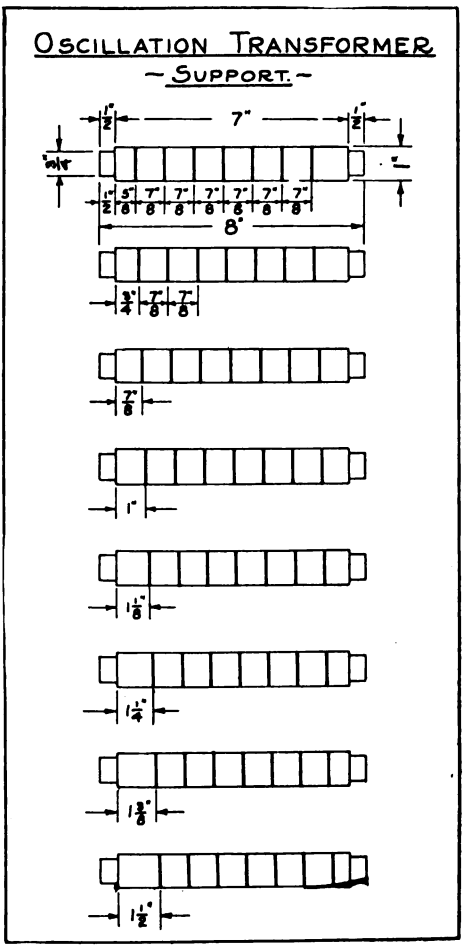


*Fig. 3, Third Prize Article*

considered. The distinctive feature of this instrument is that the entire primary circuit inductance can be varied by a single turn at a time; in fact any number between 1 and 410 turns can be instantly thrown into the circuit by the switches mounted on the front. This arrangement of connections insures very accurate and sharp tuning. It will be seen from the diagram of connections that by adding the numbers upon which the switch arms rest the total number of turns in the circuit can be easily found at any time. This enables the operator to memorize the position of the switches for a certain transmitting station.

The aerial tuning inductance tube has the following dimensions: Length, 6 inches; outside diameter, 4⅛ inches; inside diameter, 4 inches. It is wound with 200 turns of No. 26 B. & S. gauged enameled copper wire; a tap is taken off every tenth turn and connected to the aerial tuning inductance switch, as shown in the diagram of connections. It is mounted in the upper slot of the pieces for the support of the primary inductance.

The primary tube is of the same dimensions as the loading coil and is wound with 210 turns of No. 26 B. & S. enameled copper wire. For the first ten turns a tap is taken off every turn and for the remaining distance a tap is taken off every ten turns. This tube is mounted in the lower slot.

The secondary winding consists of

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No. 30 B. & S. gauged enameled copper wire on a tube 6 inches in length, 3¾ inches outside diameter and 3⅝ inches inside diameter; a tap is taken off every half inch and connected, as shown in the diagram of connections. The secondary coil heads, previously described, should fit snugly into the end of the coil. These heads are tied together by a 3-16 inch tie rod capped with a cap nut at each end. The completed secondary slides in and out of the primary winding on a ¼-inch square brass rod, the end of which rests on a hard wood or hard rubber pillar, G. The variation of coupling is produced by the rotary movement of the knob to which are attached two arms, HH. No dimensions are given for these arms, as it is expected that the maker will experiment until the right lengths are obtained. These two pieces are bolted together by a small machine screw.

It will probably be difficult for the average amateur to obtain a vacuum valve detector and if a bulb cannot be purchased outright it is recommended that a complete RJ-4 or RJ-5 detector be removed from the case and mounted on the front of the panel. The rheostat is mounted on the inside of the case, the shaft extended and a knob and pointer with suitable scale attached on the outside. The case containing the vacuum valve battery is screwed down on the inside of the cabinet and the cells connected in single sets to the vacuum valve battery switch.

The posts for the lighting battery are mounted on the right hand end of the case, the current being turned on and off by the push button switch at the right of the bulb. The degree of incandescence of the filament is varied by means of the rheostat.

A perikon detector has been included in this set for use when the audion is out of commission or when it is desired to receive nearby high power stations. This detector consists of a 5-hole detector cup mounted in a vertical position with a smaller cup fitted with a receptacle to hold one crystal to bear against it. Perikon crystals can be purchased from supply houses.

A buzzer testing set for obtaining a sensitive adjustment on the crystal detector is also contained in this cabinet and is operated by a small pearl centered push button on the front panel below the vacuum valve. Binding posts for the aerial and earth connections are mounted on the left hand end of the cabinet, while the posts for the telephones are in the front. The maker should have name plates for the various switches made to order.

ARTHUR C. BURROWAY, *Ohio.*

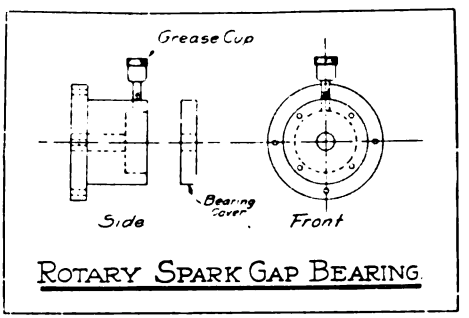


*Fig. 4, Third Prize Article*

## SECOND PRIZE, FIVE DOLLARS

### A Transmitting Oscillation Transformer Suitable for Amateurs

The From and For Those Who Help Themselves department of the The Wireless Age has published only a few descriptions of transmitting oscillation transformers. I notice from the photographs of amateur stations that this valuable and necessary piece of equipment presents a haphazard appearance, lacking the attention to mechanical and electrical details that is given to other instruments of a complete radio set.

The design I present is suitable for the use of amateurs, allowing the emitted wave-length to comply with all United States restrictions. While the coupling between the primary and secondary winding is mechanically fixed, it can be electrically altered by the use of two clips at the secondary winding. In this manner the used turns of the secondary winding can be

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placed at any desired distance from the primary winding, thereby lessening the mutual inductance and, hence, the coupling.

It will be observed that use is made of a copper strip wound edgewise which works for compactness and at the same time gives a considerable degree of conductivity for a given value of inductance. This strip was purchased from the Clapp-Eastham Company at a nominal price.

The material required for the construction of the oscillation transformer is listed as follows:

Twenty-eight turns edgewise copper strip, 7½ inches inside diameter, ½ inch in width and 1-16 of an inch in thickness; two sections are required, one of 10 turns and one of 18 turns respectively; four hard rubber or fibre uprights, 8¾ inches by ¾ of an inch by ½ inch; eight round head brass machine screws, 1 inch in length; one top of birch, 9¼ inches in diameter by ¾ of an inch in thickness; one base of birch, 9¼ inches in diameter by ¾ of an inch in thickness. I have taken pains in Fig. 3 to measure as near as possible the exact position of each slot on each strip. These slots are 1-16 of an inch in width and ¼ of an inch in depth. Notice that the upright A slots begin ¼ of an inch from the bottom, the upright B 5-16 of an inch from the bottom, the upright C ⅜ of an inch from the bottom, and the upright D 7-16 of an inch from the bottom. It is advisable to cut the slots at a slight slant, similar to the slant of the copper strip. This will make a snugger fit.

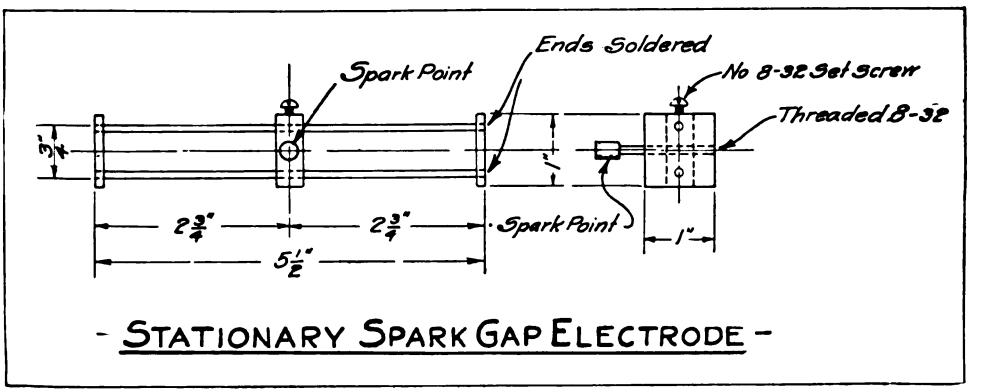


*Fig. 5, Third Prize Article*

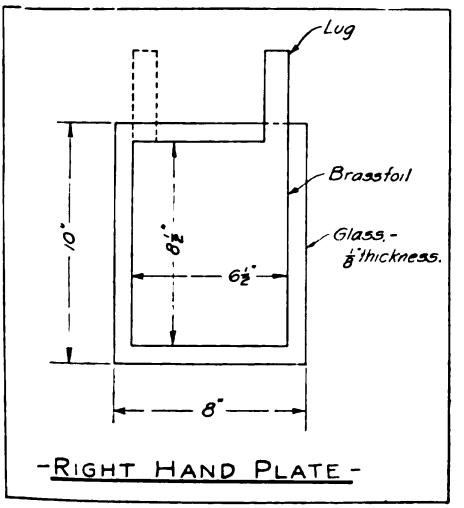


*Fig. 6, Third Prize Article*

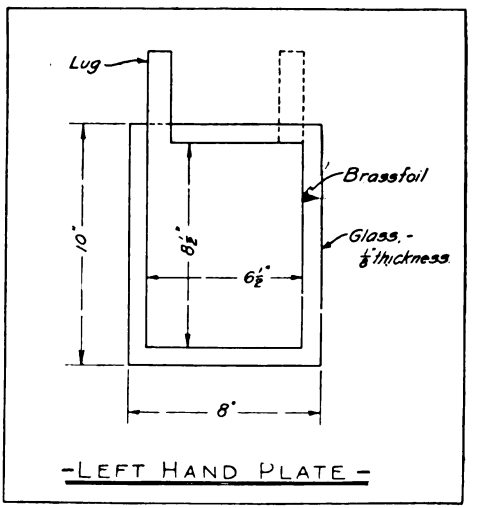


*Fig. 7, Third Prize Article*

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The base and top are turned from birch to the size stated and stained mahogany. The holes are spaced evenly,

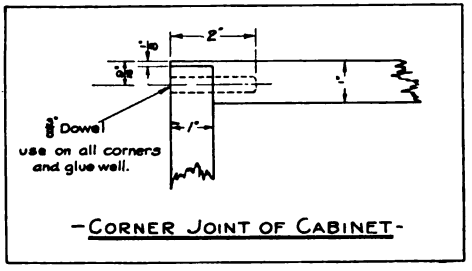


*Fig. 8, Third Prize Article*

as per Fig. 2. These holes should not be countersunk. In the assembly it would be better to fit the uprights first and place the top and bottom on afterwards.

The drawing for the assembled apparatus (Fig. 1) is largely self-explanatory and, if followed in detail, a

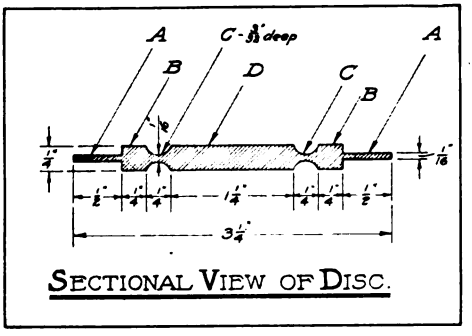


*Fig. 1, Fourth Prize Article*

very efficient and compact transformer will result.

The ten turns are intended to be employed as the secondary winding. If desired an aerial tuning inductance can be constructed along the same lines.

R. HOAGLUND, *Massachusetts.*

## THIRD PRIZE, THREE DOLLARS

### A Cabinet Transmitting Set Which Is Compact and Durable

Like the cabinet receiving set, the cabinet transmitting set is characterized by compactness and neatness; this, coupled with the fact that very short leads are obtainable in the oscillatory circuits, renders the apparatus ideal for the use of amateurs. The set I am about to describe, which has been in use for a number of years in my station, has not met with a single breakdown; for this reason I believe that the details of construction may be of interest to the amateur field.

A general top view of the set is shown in Fig. 1 and a front elevation in Fig. 2. Note that the transmitting oscillation transformer, the rotary spark gap, and the driving motor are mounted on the top of the cabinet, the gap being driven by a small belt. The inside of the cabinet is fitted with a tin lining so that the transformer and transmitting condenser can be immersed in insulating oil. Other details are shown in Figs. 3, 4 and 5.

The transformer is of the usual

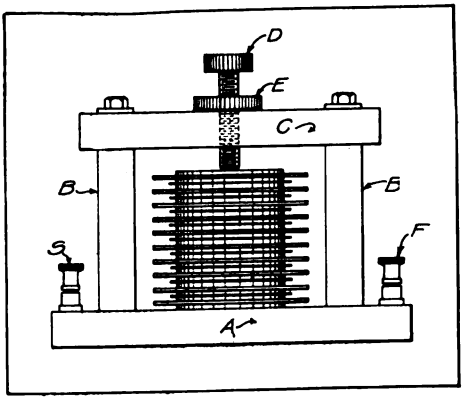


*Fig. 2, Fourth Prize Article*

closed core type being assembled in the regular manner. The complete materials required are as follows:

Eleven pounds of No. 10 B. & S. D. C. C. magnet wire; eleven pounds of No. 32 B. & S. D. C. C. magnet wire; forty-five pounds of soft transformer core iron; three yards of empire cloth.

The core is of the standard rectangular design, being made up of a number of iron strips 2 inches by 15 inches and 2 inches by 8¼ inches. These are piled up in the usual manner, forming legs upon which the primary and secondary windings are mounted. The core should be wrapped with several layers of empire cloth until a thickness of ¼ of an inch is obtained. The primary winding comprises four layers of No. 10 wire with a tap-off at the second, third and fourth layers. The taps

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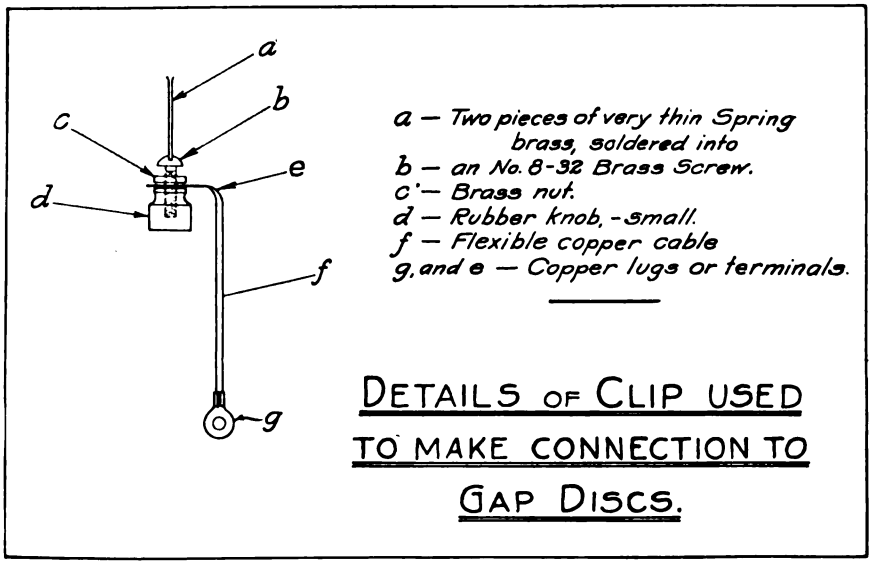
a
b
c
d
e
f
g
a — Two pieces of very thin Spring brass, soldered into
b — an No. 8-32 Brass Screw.
c — Brass nut.
d — Rubber knob, - small.
f — Flexible copper cable
g, and e — Copper lugs or terminals.
DETAILS OF CLIP USED TO MAKE CONNECTION TO GAP DISCS.

*Fig. 3, Fourth Prize Article*

for the primary winding are brought out to the front of the cabinet and connected to the multiple-point switch as shown.

The secondary sections are ¼ of an inch in thickness and are wound on a mandrel 2½ inches square. When completed the secondary winding will contain twenty-four of the "pies." Each of the secondary sections are separated by three discs of empire cloth. Care should be taken to see that the wire runs in the same direction when the various pies are being connected together. It will facilitate the insulation of the secondary winding if the wire is run through melted paraffin during the winding process. In fact this is absolutely necessary if it is desired that the transformer withstand continued service. The secondary terminals are attached to two porcelain insulators on the side of the cabinet as indicated in the drawing. When complete the transformer is placed in the bottom of the cabinet as shown and filled with boiled linseed or transformer oil.

The condenser requires forty plates of glass 8 inches by 10 inches and four pounds of 6-inch extra thin brass foil. The latter can generally be obtained in any machinery supply store. There should also be purchased two metal containers to fit the inside of the condenser's compartments. As stated previously the complete condenser is made up of two units; that is to say, twenty plates are connected in parallel and the two units of twenty connected in series. The plates of each unit should be stacked in a pile and a connecting lug brought up from each plate, as shown in Fig. 6. These are known as left hand and right hand plates accordingly as the lug from the brass foil nearest to the observer issues from the left or right hand side of the foil. The lugs at one end of each unit should be soldered together and connected to the lugs at one end of the second unit, while the two remaining sets of lugs should be brought out to the binding post on the front of the cabinet.

Of course, if the entire condenser unit is not required, a number of the plates can remain in the container, but they must be disconnected from the other plates. When assembled, the two units are placed in the metal container and immersed in transformer or boiled linseed oil.

In my design of the rotary spark gap I have shown a disc 5¼ inches in diameter, suitably mounted and enclosed

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in a muffling drum, the disc being driven by a 1-20 horsepower motor having a speed of 1,800 R.P.M. Generally each amateur has his own idea of the ideal rotary spark gap and for this reason I have omitted a detailed description. The disc I employ has 12 points, the complete circuit for the spark gap being made between 2 stationary electrodes.

In order to construct the oscillation transformer shown in the drawing there are required for the secondary winding 25 feet of No. 18 B. & S. aluminum wire, 20 feet of No. 6 B. & S. aluminum wire, and 6 feet of ¼-inch round brass rod. The lid of the container for the condensers is used as the bottom support for the drum of the primary winding, while the octangular shaped piece is formed for the top support. The uprights supporting the coil are shown in detail in Fig. 3. There are eight of these for the primary and secondary drum. The secondary upright has twelve slots instead of seven. For supporting the secondary drum three 2-foot brass rods are arranged in a triangle, as shown in the drawing. The various instruments comprising the oscillatory circuit are connected with ½-inch copper strip, for which about four feet will be required.

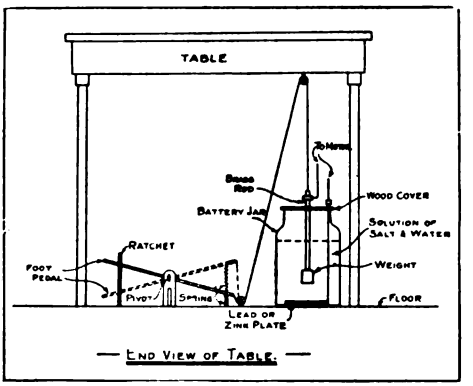
When this apparatus is completed the transformer will draw about 1 k.w., but in order that the set may comply with the United States restrictions, it will be necessary to reduce the size of the condenser, which may be accomplished as previously explained.

A. D. HORN, *Ohio.*

## FOURTH PRIZE, SUBSCRIPTION TO THE WIRELESS AGE

### How to Construct a Quenched Spark Gap at Comparatively Small Cost

Many amateurs have been prevented from using the so-called quenched gap because they believe that the construction of it is expensive. While it is impossible to construct the discs for the gap without a lathe, the writer overcame the difficulty of paying for a considerable amount of machine work by making the discs in the following manner: In the sectional view (Fig. 1) the disc, D, is turned from a piece of sheet brass 3¼ inches in diameter. The actual sparking surface ,D, is an inch and a quarter in diameter, and the insulating groove, C, is ¼ of an inch in width by 3-32 of an inch in depth. The radiating flange is ½ inch in width by 1-16 of an inch in thickness. A small hole ⅛ of an inch in diameter is drilled through the disc in the center. This is to enable the disc to be lifted out of the




*Drawing, Honorary Mention Article, Robert C. Bishop*

sand when having a mould made. Any machine shop will turn out a disc of this construction for fifty cents at the most.

It is next in order to inquire from the machine shop where copper castings can be made. The disc can then be taken to the proper foundry and about a dozen cast in copper from the very finest sand, as this will eliminate further lathe work. Each disc upon completion will weigh about 3½ ounces. The cost may be readily reckoned, as copper castings are now rated at from twenty-eight to thirty cents per pound. The discs when cast will be slightly rough, but this is only of consequence at the parts B and D (Fig. 1). The discs can be made smooth by placing a piece of very fine emery cloth on a perfectly flat surface—a piece of marble will serve the purpose. Now lay the disc on the emery cloth and grind down the face of the former until the parts, B and D, are perfectly smooth and true. It should be noted that this operation cannot be performed with a file or on an emery wheel.

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The insulating washers to be placed between the discs come next in the order of construction. Mica is used by certain commercial companies, but it is difficult to cut without breaking and at the same time rather expensive. However, a good grade of empire cloth will do as well, being much less expensive and easier to handle. Washers of this type should be as efficient as mica because they are used on commercial quenched spark sets. The washer is 2¼ inches, outside diameter, with a 1½-inch hole. If cut to this size the washers will project slightly over B on the radiating flanges and half way over the insulating groove, C. This is an important consideration because it prevents the washers from burning and short-circuiting the disc. Two, or perhaps three, thicknesses of empire cloth will be required for each washer, as the distance between sparking surfaces when the plates are pressed together should not be more than 1-50 or 1-100 of an inch.

Many methods of mounting the discs will suggest themselves. The writer set his up as per the sketch, which is largely self-explanatory. A black fibre base, A, 7½ by 4½ inches, has two brass pillars, B, the height of which are to be regulated by the maximum number of discs to be used. A strip of black fibre, C, ¾ of an inch in thickness by one inch in width, drilled and tapped in the center to take the brass thumbscrew, D, compresses the discs so that the spaces between the latter are air-tight. The thumb screw is locked by the brass nut, E.

Two binding posts are placed in the base, F and F. To make connection to the disc two very small clips are made, as per the sketch, and connected to the binding posts, F and F, by means of two short pieces of heavy flexible cable. By this method any number of discs may be used without dismounting the gap, connection being made to the radiating flange at the number of gaps desired.

The complete gap as described cost the writer about $2.50, but it is the equal of anything that can be purchased for four or five times that amount. The gap is particularly suitable for use in connection with amateurs' small transmitting sets and if the power employed exceeds ½ k.w. the gap should be cooled by means of an electric fan.

J. Furlong, *Massachusetts.*

## HONORARY MENTION

### A Rheostat That Can Be Operated by Foot and the Advantages of the Apparatus

There are times in the experience of every wireless amateur when he wishes he had three hands or perhaps could call upon his feet to make some of the necessary adjustments of a wireless telegraph transmitting or receiving apparatus. It occurred to the writer that the rheostat for the rotary spark gap might be operated by the foot, as this would give a free hand for working additional equipment, besides leaving more room on the switchboard.

As will be observed from the accompanying diagram, my starting rheostat is home-made. It consists of a battery jar which is filled about three-quarters full of water, to which a pinch of salt is added. The brass rod slides up and down through the hole in the middle of the cover. The nearer the rod gets to the zinc (or lead) plate in the bottom of the jar, the faster the motor runs, or vice-versa. This movement is accomplished by attaching a string to the rod and foot pedal, as shown in the diagram.

A ratchet to hold the pedal is held in different positions by a piece of tin about two inches in length, nailed to the pedal which catches in the notched upright shown to the left of the drawing. This upright, as well as the pivot on which the pedal rests, should be securely supported, as it undoubtedly will get hard usage, particularly when you are in a hurry to "break in" upon some offender. One of the holes in the uprights of the pivot should be made slightly oblong to allow for side-motion caused by the ratchet.

I believe the average amateur will find this scheme far superior to the ordinary hand rheostat.

Robert C. Bishop, *New York.*

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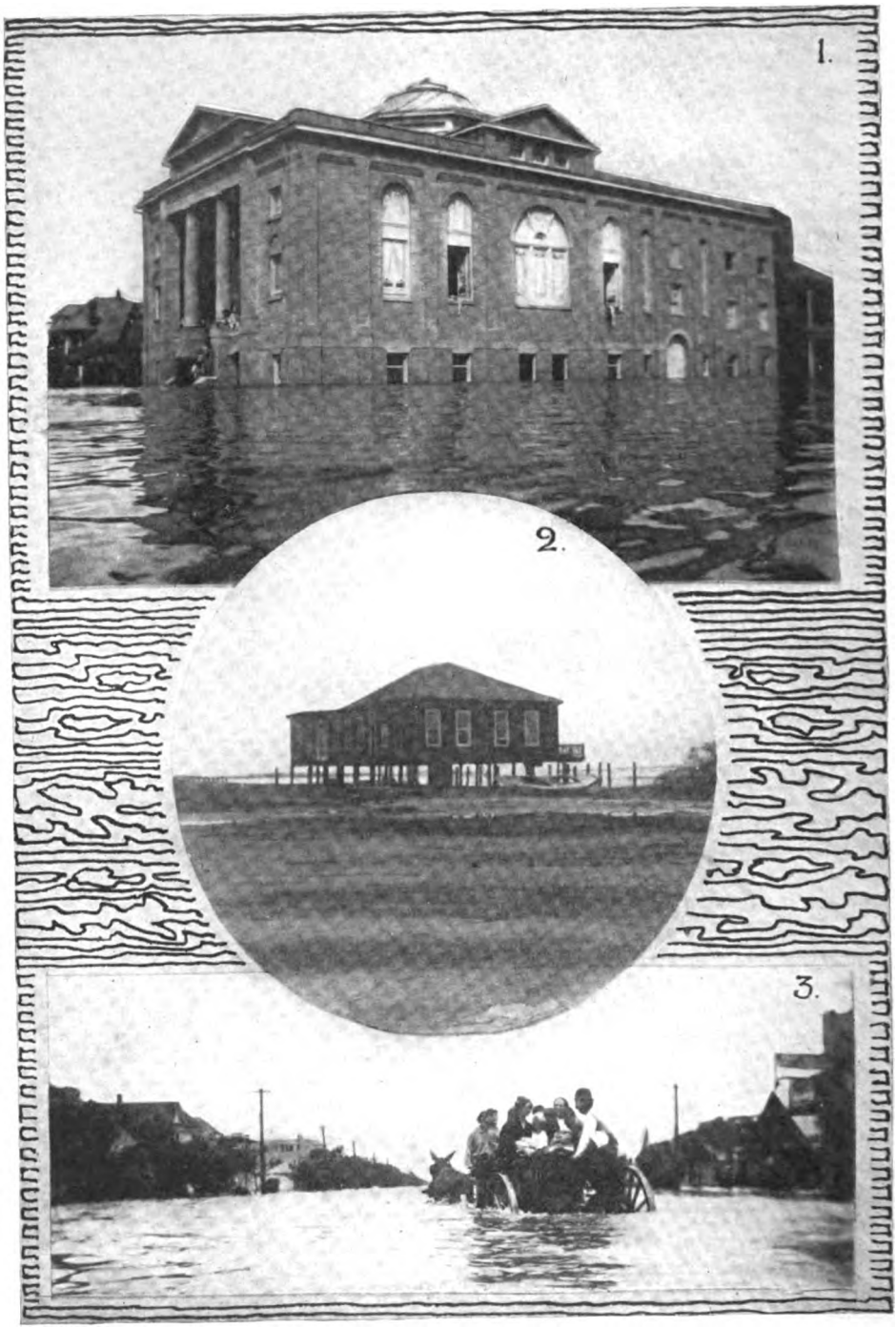
# The Story of the Texas Tornado Told in




(1) *A view of the new Christian Science Church in tornado-swept Galveston when the flood held full sway*

(2) *The Marconi station in Galveston. The structure escaped damage, but the mast and some of the guy anchors were carried away by the waters*

(3) *Horses and wagons were employed to excellent advantage in transporting victims of the flood and their possessions from the inundated sections of the city*



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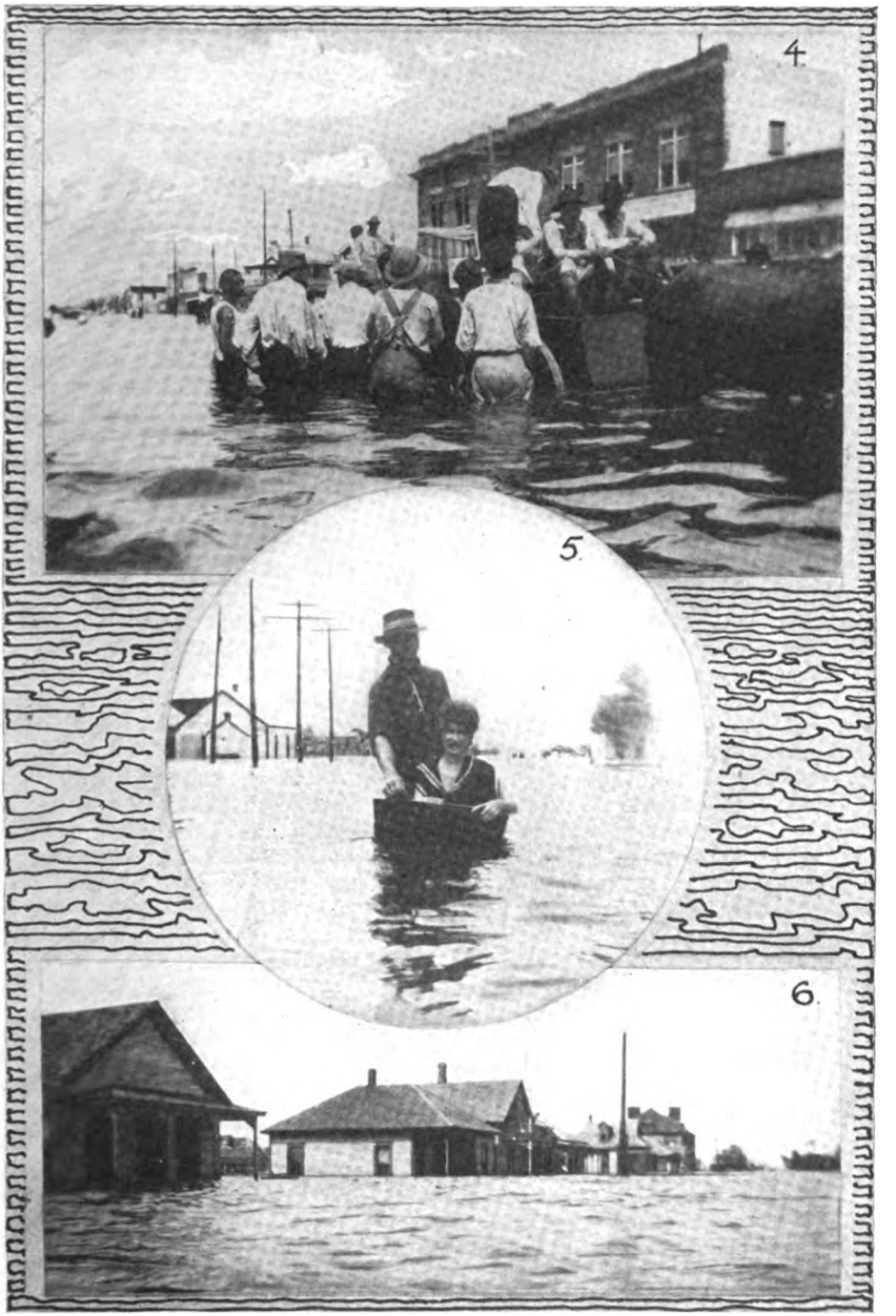
# Photographs Taken By a Wireless Man




(4) *Distributing bread among the hungry folk in a water-filled street in Galveston*

(5) *Means of transportation by water were not always available. This photograph shows that washtubs can be advantageously employed for other uses than those to which they are put by housewives*

(6) *Port Arthur also sustained considerable damage as a result of the tornado. This is a view of a section of Shreveport avenue*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# How to Conduct a Radio Club

**By Elmer E. Bucher**

**Article XVII**

MEMBERS of radio clubs frequently disagree regarding the choice of a circuit affording the highest degree of efficiency for the various types of receiving detectors. An inductively-coupled receiving tuner of one design is not always applicable to the various types of rectifiers and "trigger" devices now available; therefore a few words of explanation in reference to tried and tested circuits may be of value.

The preferred method of connection for the carborundum and electrolytic detectors is presented in Fig. 1. The secondary circuits of the receiving tuner are indicated by the inductance, L-2, the condenser, C-2, etc.

Within the range of wave-lengths it is desired to work, the secondary winding, L-2, should have such values of inductance that no more than .001 microfarad is required at the condenser, C-2. The fixed condenser, C-1, generally has a value of .003 microfarad, although it may vary from .0025 microfarad to .005 microfarad. The potentiometer, P-2, should have a total resistance value of 300 to 400 ohms and should be fitted with the sliding contact, N. The battery, B, should consist of two dry cells for the carborundum and three for the electrolytic. The head telephone, P, should have a value of 2,000 ohms. The circuit described should be of particular interest to those about to take the United States Government examination as well as to the members of radio organizations.

A method of connection particularly applicable to the silicon and perikon detectors is shown in Fig. 2. Contrary to the general belief, increased strength of signals is obtained by the application of a slight voltage to the crystal. In this case the potentiometer, P-2, may have a resistance value of from 300 to 400 ohms, but there must be included in series therewith a fixed resistance, R, of about 1,800 ohms. The added resistance permits the voltage of a single cell to be reduced to a very low value, an extremely important consideration in the case of these detectors.

The condenser, C-2, should never exceed .002 microfarad in value, while C-1 may, in this case, be as large as .04 microfarad. This method of connection has been largely employed in tuners supplied to the United States Navy. It will be observed that the local battery circuit to the crystal flows through the secondary winding of the receiving tuner so that an open circuit or imperfect contact can be quickly observed.

A receiving tuner designed for crystalline detectors does not in many cases represent the proper proportions of inductance and capacity for use with the vacuum valve detector. A circuit suitable for the two-element valve is shown in Fig. 3. For a given wave-length the secondary winding, L-2, should have a high value of inductance, and the condenser, C-2, a small value of capacity. To be more explicit, C-2 should never exceed .0001 microfarad. Therefore it may consist of two small concentric brass tubes sliding over each other, allowing the capacity value to be closely adjusted. The fixed condenser, C-1, may have a value of .005 microfarad.

The filament rheostat, P-3, has a maximum resistance of ten ohms, while P-2, the potentiometer, should represent about 400 ohms. In certain types of valves, the battery, B, is of four volts. Other types of valves are furnished in which the filament requires twelve volts.

For the three-element vacuum valve, as in Fig. 4, the secondary circuit of the receiving tuner must possess characteristics similar to that of the two-element valve, that is to say, inductance must predominate at the secondary winding, L-2, and the condenser, C-2, should be at a minimum value. The maximum value allowable for a particular wave-length is .0005 microfarad, but is preferably not more than .0001 microfarad. The condenser, C-1, should be variable in capacity and have no more than .0001 microfarad. The lighting battery, B-1, is of four volts; B-2 should have from twenty-five to seventy-five volts, dependent upon the degree to which the bulb has been exhausted. The rheostat, R, has a



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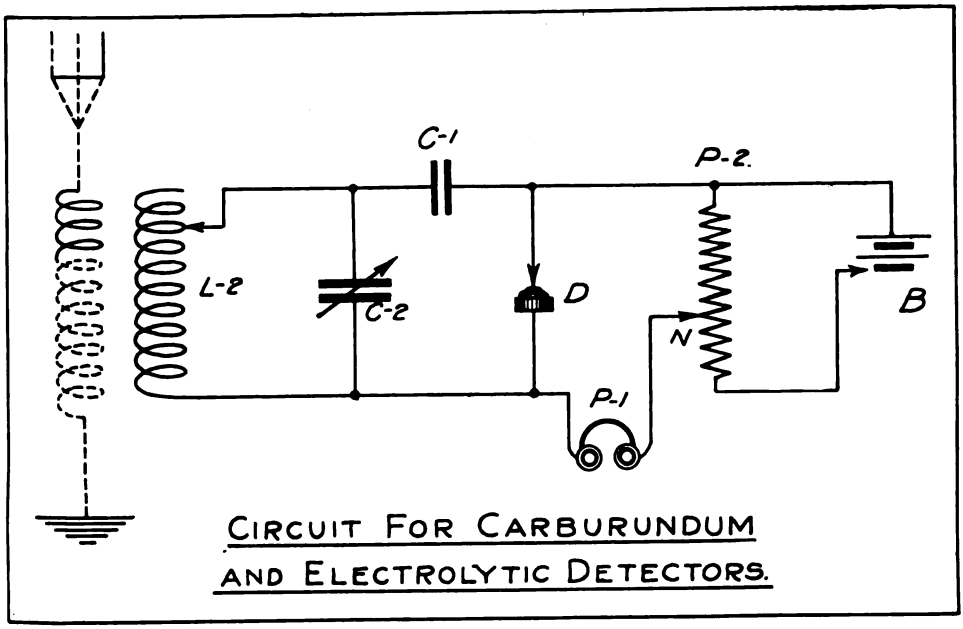


*Fig. 1*

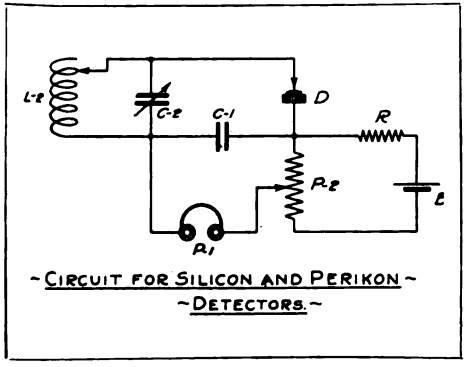


*Fig. 2*

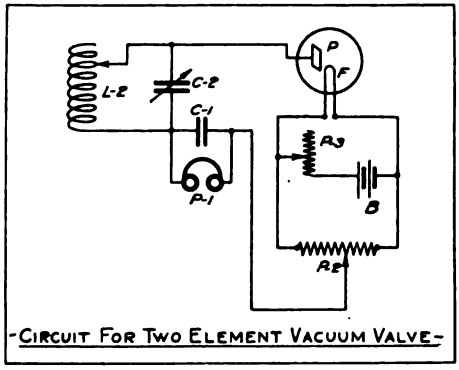


*Fig. 3*

resistance of 100 ohms and the head telephone from seventy-five to 3,000 ohms.

It is important for the maximum strength of signals that the diagram of connections and the polarity of the battery given in Fig. 4 should be duplicated. The positive pole of the high potential battery, B-2, must be connected to the plate of the valve, P, and the negative end of B-2 connected to the positive end of B-1.

The signals from spark stations can be increased in intensity by placing the condenser, C-3, in the local battery circuit, as shown in Fig. 4. This condenser should have a value of .005 microfarad.

The circuits of a receiver suitable for undamped oscillations are indicated in Fig. 5. Herein T is a tikker of the slipping contact type described in a previous issue of THE WIRELESS AGE. In this case the condenser, C-1, may have a high value of capacity, good results having been obtained with a condenser of the order of 1 microfarad. The head telephone, P, should have a resistance of about seventy-five ohms.

It has been found by experiment that the secondary circuit, L-2, C-2, can be loosely coupled to the antenna system

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and also, owing to the fact that the tikker, T, is of low resistance, the secondary winding, L-2, can have a smaller value of inductance than that ordinarily supplied for a similar range of wave-lengths in connection with crystalline detectors. Generally speaking, the winding, L-2, has a low value of resistance, being made of "Litzendraht" or similar stranded wire.

In order that the received note may have a more agreeable tone, a crystal rectifier, D, is often connected in series with the tikker, T. In this case the condenser, C-1, the inductance, L-2, and the condenser, C-2, may have values throughout similar to that employed with regular crystalline detectors. The telephone, P, should have a high value of resistance, somewhere in the vicinity of 2,000 ohms. This circuit is fully shown in Fig. 6.

The United States Patent Office recently issued a patent covering a unique method for the detection of undamped oscillations. The writer made experiments with a circuit of this type many months ago and has been enabled thereby to receive radio signals from a considerable distance. A qualifying condition of this system is that the wave-length of the transmitting station must lie between 7,000 and 12,000 meters.

Referring to Fig. 7, the coil, L-1, varies in length, according to the frequency of the received wave, that is to

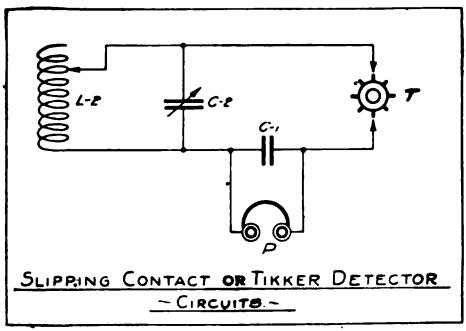


Fig. 5

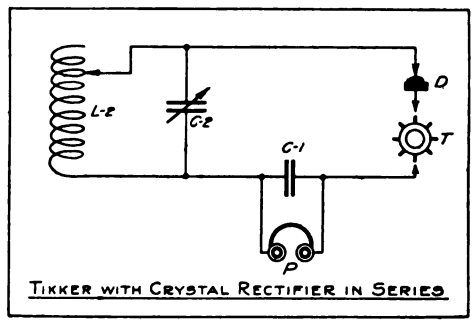


Fig. 6

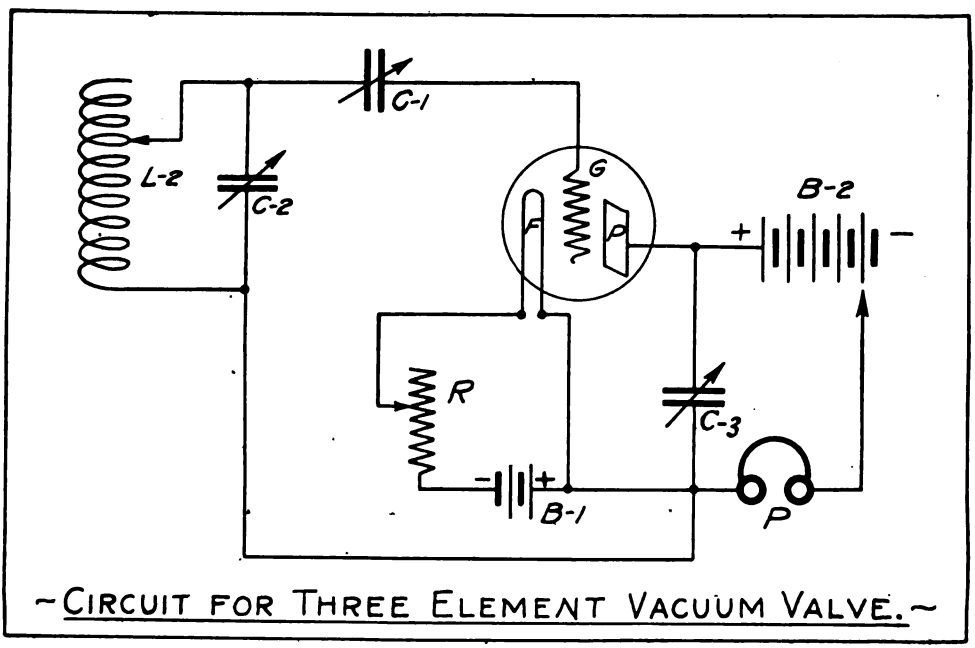


Fig. 4

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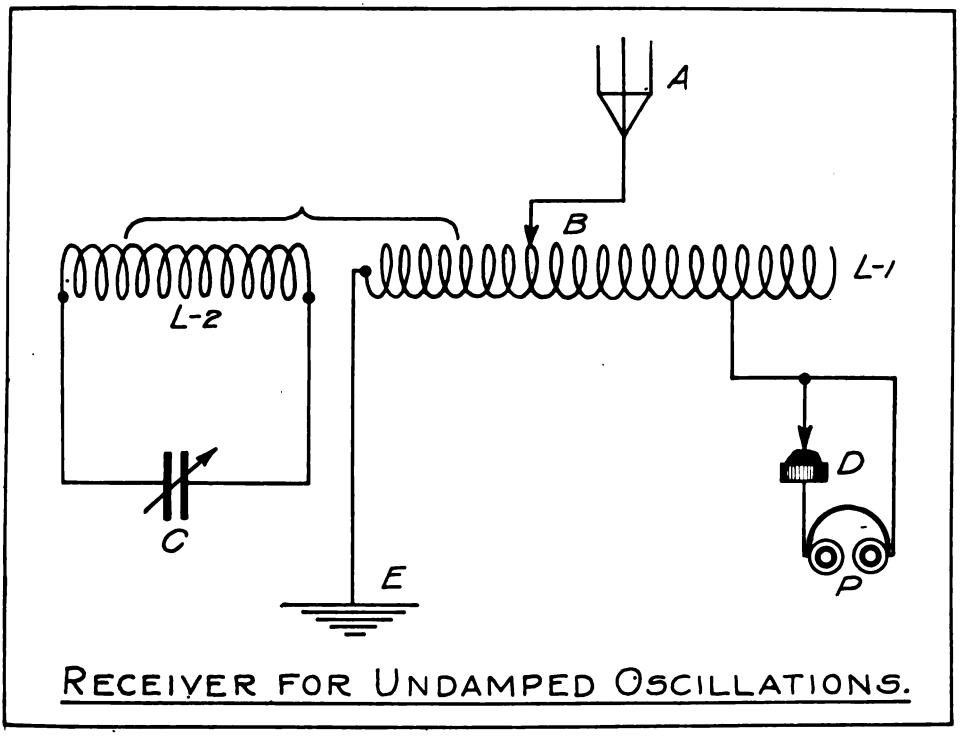


*Fig. 7*

say, it must have a natural time period of oscillations suitable to the received energy. A variable tap-off, B, from the antenna, A, allows the antenna to be placed in resonance with the coil, L-1. The crystal detector, D, preferably of the cerusite or silicon type, is shunted by the head telephone, P, and connected unilaterally to L-1.

The circuit comprising the coil of inductance, L-2, and the condenser, C, has such values that it can be placed in resonance with the coil L-1. With a slight degree of coupling between L-1 and L-2 the reaction of L-2 upon L-1 will cause the received energy in the antenna system to set up oscillations of two frequencies in the complete circuit. If these frequencies differ by a certain amount, "beats" suitable for maximum response in the head telephones are produced. The writer found it difficult with this apparatus to produce a resultant note having musical characteristics such as may be obtained by the circuits of the vacuum valve detector. The tone usually resembles that of escaping steam from a radiator, but is of sufficient clearness and intensity to allow the reception of energy from undamped stations for a distance of several hundred miles. To cover wave-lengths in the vicinity of 8,000 meters the coil, L-1, should be 32 inches in length, by 5½ inches in diameter, wound closely with No. 30 S. S. C. wire. The coil, L-2, should be 22 inches in length by 5 inches in diameter, wound closely with No. 30 wire.

The condenser, C-2, should have a value of .001 microfarad and is, of course, variable in capacity.

To insure resonance between the coil, L-1, and the antenna system, it is preferable to employ a wave-meter, set into excitation by a buzzer and battery. The inductance coil of the wave-meter is placed in inductive relation to the earth lead of the coil, L-1, and the crystal detector, D, tapped off at various points on L-1, until the maximum response is secured. It would, of course, be preferable for the coil, L-1, to have a different length for each change of wave-length; dead-ends are to be avoided.

*(To be continued)*

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**Vessels Recently Equipped With Marconi Apparatus**

| Names | Owners | Call Letters |
|---|---|---|
| s. s. Atlanta | Cuba Improvement & Steamship Co. | KGR |
| s. s. Yoro | Vacarro Brothers | VY |
| s. s. Toyohashi Maru | Nippon Yusen Kaisha Steamship Co. | YSS |
| s. s. Wyvisbrook | Brook Steamship Co., Ltd. | MCT |
| S. Y. Roamer | Shellfish Commission of the State of Florida | KZN |
| s. s. Silver Shell | Silver Shell Steamship Co. | WIA |
| s. s. Mongolian | Indian & Peninsula Steamship Co. | YTD |
| s. s. Trinidad (re-equipped) | Quebec Steamship Co. | GBH |
| s. s. Retlaw | Standard Oil Co. of New Jersey | YTF |
| s. s. Palacine | Standard Oil Co. of New Jersey | YTG |

## THE SHARE MARKET

New York, September 21.

What slight changes appear in the market quotations reflect the general feeling reported in the September issue. Contrary to the usual rules of investment English Marconi common, with a ten per cent. dividend paid and a million and a half dollar earned surplus, is bid for today at a still further fractional decline. Industrial securities of countries engaged in war apparently are still unattractive to the American investor.

The effect of the lowered pound sterling rate is not expected to remain a bearish factor much longer, for it now seems assured that the billion dollar Anglo-French loan will go through when interest questions shall have been settled. On their showing as going concerns the shares of the Marconi companies should be at a higher general level, say the brokers. The reaction, slight though it is, seems to point toward unwelcome speculative activities. In the opinion of one prominent trader, the investing public's unresponsiveness has caught the professionals long of the market and this element is endeavoring to release Marconis purchased abroad so they may direct their efforts toward the widely fluctuating "war stocks." This situation, it is maintained, accounts for the effect on American Marconi prices. Yesterday's trading in the latter issue totaled 2,000 shares, the market remaining firm at the established figures. Canadian Marconi reflects the slight off change and is weak. Spanish and Wireless Trust appeared this morning for the first time in months at the asked price of 3½.

Bid and asked prices today:

American, 3⅞-4⅛; Canadian, 1⅜-1⅝; English, common, 9-12½; English, preferred, 8½-12.

## POULSEN RIGHTS ACQUIRED BY MARCONI

Under date of September 15, New York newspapers printed cable dispatches from the London Daily Chronicle stating that:

"A syndicate representing Marconi interests has acquired the Poulsen-Padna rights, and in due course the Poulsen system will become part of the Marconi organization."

According to this authority, an important option in connection with the British Poulsen wireless rights lapsed recently, though fresh arrangements would quite possibly have been made. In the meanwhile, however, the syndicate representing the Marconi interests, made an offer.

For the present, owing to Treasury restrictions, formation of a subsidiary company and other financial arrangements for the completion of the deal can not be put through, but after the conclusion of peace it may be looked upon as certain that Poulsen will be under the Marconi banner.

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# My Mental Picture of the Death of the Santa Rosa

By Walter Burnett

IN these active days of invention and discovery, startling scientific achievements and new industrial activities, few persons may be expected to remember that eventful night, several years ago, when the good ship Santa Rosa heard the call of fate, fought valiantly through tragic hours and, defeated and subdued, finally sank to oblivion. Nevertheless, her memory is cherished by many a former passenger who knew the stanch, reliable steam vessel that plowed the coastwise waters of the Pacific for a quarter of a century; for these good people and those amateurs who may have played, as I did, a silent part in the drama, let me tell the incidents bearing upon her destruction. My viewpoint may be a new one, for I was one hundred miles away in the hour of her doom; with her pleading wireless calls pounding into the sensitive receivers pressed tightly against my ears, I sat alone, helpless to aid.

BEFORE the advent of the modern, turbined palaces which gradually forced her to second place, the Santa Rosa was the aristocrat of all vessels in the passenger service between San Francisco, Los Angeles and San Diego. Her spacious decks and cabins gave footing and shelter to happy bridal pairs and aged couples venturing upon the sometime choppy sea of matrimony unafraid, even as the Santa Rosa trod the waters of the Pacific. One pictures a young couple of two decades ago, on their honeymoon, occupying a sheltered nook on the deck, their love-notes mingling with the music of the throbbing steel heart below. A score of years later the son of that happy union crouches shivering in his scanty night attire, listening to the death cry of the very ship on which the couple had voyaged. Memory has given the first picture; wireless telegraphy (in those days just beginning to evolve from a dream) brought to me the second harrowing tableau.

Years had made little change in the sturdy Santa Rosa; she paced the sea lanes unaffected by time until an early morning in July, 1911.

I was a wireless amateur then, emerging triumphant from a struggle for mastery of scientific formulas and Continental Morse. Searching in the dimly lighted labyrinth of ether wave phenomena, wireless had become my very life-work. Or so it seemed. Late at night wireless comes into its own, and it was when the sun had sunk to rest and the peace-destroying clamor of industry was stilled, when darkness had displaced daylight and the potential energy sleeping in the magnetic heart of powerful radio generators crashed forth through spark-gaps and set the elastic ether in vibratory motion—then I was happy. Nothing approached the wonder of caging these ether waves in sensitive head-phones and transforming them into readable script through the medium of that wonder of all wonders: the human mind.

As with all successful wireless amateurs my dominating ambition was to receive "long distance," a feat then possible only some time near midnight.

That it should not be necessary to remain up so late, I had, before retiring, been carefully tuning my sensitive instruments to the wave-length generally utilized by commercial companies, disconnecting the head-phones from the instrument table and connecting them to specially arranged binding posts at the side of my bed. The instruments of my mentality were tuned to produce wakefulness in the hours shortly after 1 a. m., and to this day they seldom fail me, provided they have been energized by a self-created thought just before retiring at night.

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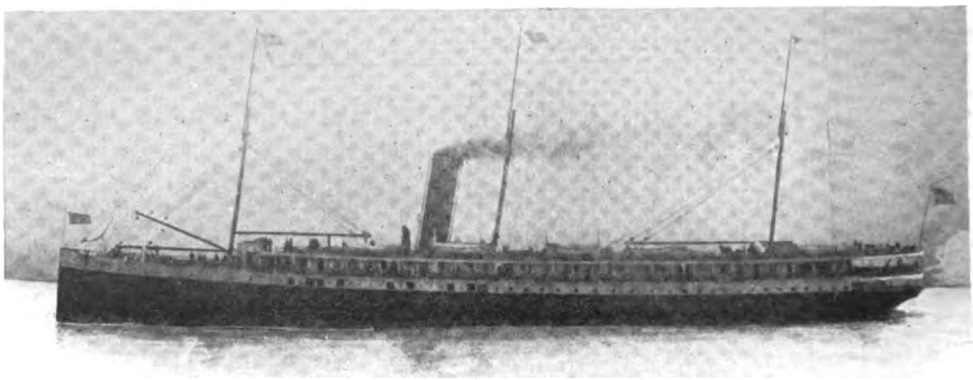


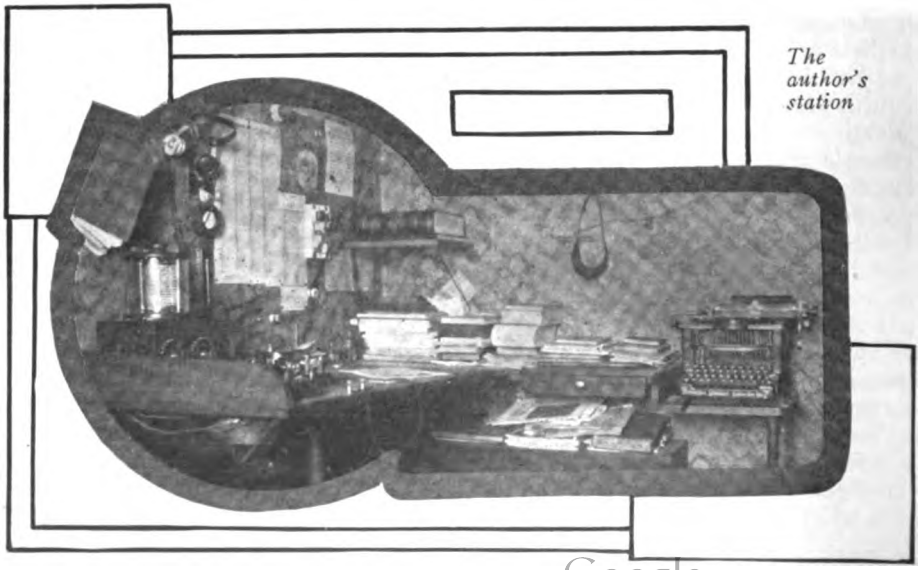
*The Santa Rosa, stanch and reliable Pacific coaster, whose death cries were heard in the amateur set*

True to the rousing power contained in the thought, early on that July morning in 1911 the mental switch was automatically thrown from sleep to consciousness.

Reaching for my head-phones I placed them in position and listened. Save for a few intermittent splashes of ever-active static, the ether was silent. Not a sound broke the stillness of the night; the whole world lay sleeping. Waiting thus for the far away sparks that must break the silence sooner or later, I dozed. Suddenly the clear, high tremolo of a wireless transmitter brought me to full consciousness. For a moment or two I listened, half protesting at the rude disturbance.

Then a stabbing nerve tremor shot through my frame! My mind had translated those alternating dots and dashes into the universal distress call. S O S! S O S! It seemed literally to *scream!* I sat erect, thrilled, appalled! Somewhere out there in the black night a fellow creature—and perhaps hundreds of other humans—was in peril, was appealing to his brother man for aid.

With my pounding heart keeping time to the high, mournful tattoo of the S O S, I waited for the "sign." Cuttingly clear it came: G I. My anxiety gave way to a gripping fear. G I—the call letters of the Santa Rosa! The Santa Rosa that had time and again bucked the mightiest storms of the Pacific unafraid, was begging for assistance!



*The author's station*

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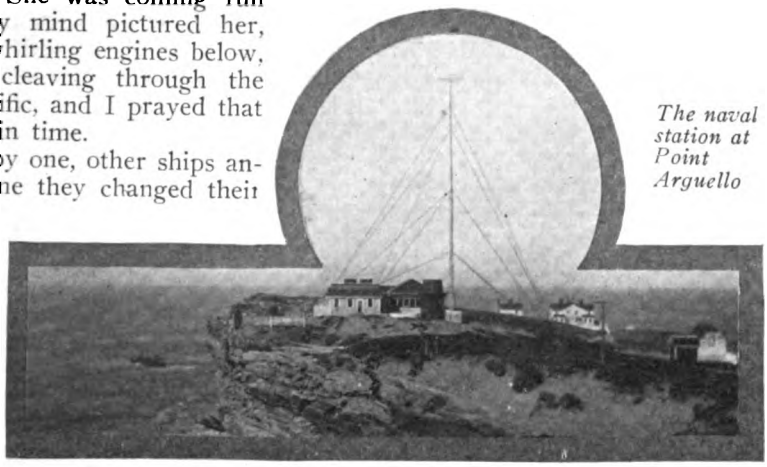
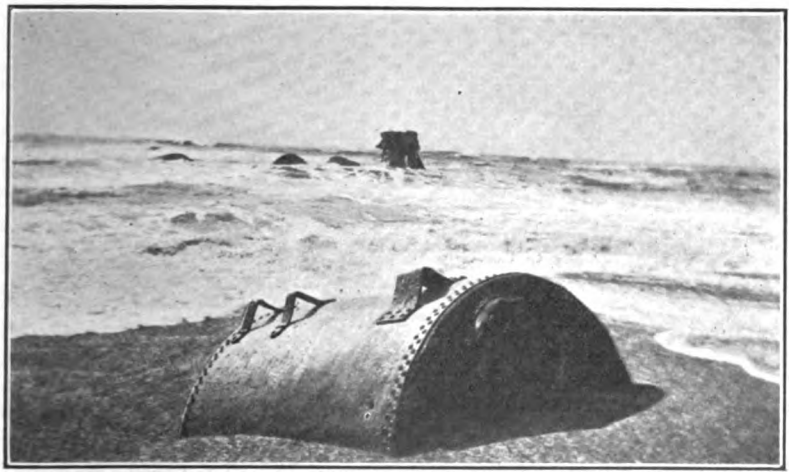
little through the interference; only the words "assist . . . off Pt. Arguello" were clear.

Then, after many torturous minutes of waiting, we heard the good old Centralia, and it seemed as if a sigh of relief went up from all who were on wireless watch that morning. The steamship had heard and answered. Eagerly we drank in her message. She was coming full speed ahead. My mind pictured her, urged on by the whirling engines below, the sharp prow cleaving through the waters of the Pacific, and I prayed that she would arrive in time.

Gradually, one by one, other ships answered; one by one they changed their courses and rushed on "full speed ahead," all bound for a common destination. Bending to the will of man, the ether had carried an appeal for help and whispered back the answer: We have heard and we are coming.



*The naval station at Point Arguello*



*All that was left when the ship broke up*

Time dragged heavily.

At last came a joyful message: The Centralia had arrived on the scene! Daringly she nosed close in, and soon a mighty hawser was run between the two ships, one so utterly helpless, the other free and powerful. Kept taut and straining by the restless engines of the rescue ship, the heavy line prevented the Santa Rosa from pounding. Then another vessel arrived on the scene, and there were two straining cables instead of one. Other succoring vessels were advised that those at hand could handle the situation, and turned back to their original courses.

With all going smoothly at the scene of the disaster, the voice of the wireless, its purpose accomplished, gradually ceased. Succeeding events did not become known until later in the day. Wireless press and the graphic accounts in the daily newspapers gave us the details.

We learned that with the aid of the rescue ships the Santa Rosa was resting so easily that her captain deemed it advisable to keep the passengers aboard, although the sea was sufficiently smooth to allow their removal in small boats.

Fatal mistake! In an incredibly short period of time a heavy sea came up and, in spite of the steadying lines, the vessel

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Mingled with the S O S were the letters N P K, a call to the Naval station at Point Arguello, 110 miles to the north of my station!

I listened for perhaps a minute; maybe it was two; it seemed, however, that a dozen heart-rending hours dragged by before the clear, high treble of N P K came pounding into the phones. Instantly the rigidness of my body relaxed. I sprang from bed, disconnected my phones and bounded to the instrument table. The Santa Rosa was now giving her position:

"On the rocks two miles west* Point Arguello!"

here and there a cool-headed one assisting the officers to restore order; the crew working valiantly at the boats—and high up in the little wireless cabin, the calm, drawn-faced operator, unafraid, unfaltering . . . alone.

I knew he was calm for I, 100 miles away, was getting his every word. He sent fast but temerity and coolness could be read in his touch.

It all seemed so near! I looked through the open window out into the darkness, half expecting to see the wave-washed ship, grinding to destruction on the rocks. But no! She was 100 miles away! All I had to bring the picture before me was

*A view of the treacherous coast upon which the Santa Rosa grounded*

The scene stood out in my mind:

An irregular stretch of great, jagged, wave-swept rocks. The long, majestic Santa Rosa hopelessly entangled, rising slowly on the crest of every incoming swell and then falling helplessly back with a crash upon the treacherous reef, struggling like some great leviathan wounded unto death.

And then the mirror of my imagination reflected the scene upon the doomed vessel's deck: A tangled mass of seawrecked superstructure; hundreds of terrified, madly stampeding passengers; the penetrating scream of that wonderful voice of science. Marconi, it breathed, Marconi—God's Man!

The steady notes of N P K (Pt. Arguello) systematically calling other ships, brought me back from my imaginative wanderings. A dozen ships he called. We had no laws in 1911 requiring a constant, skilled watch, and the answering silence was maddening. All other operators off duty, and the Santa Rosa sinking with her precious human freight!

Suddenly the tone of the station at Mare Island Navy Yard, near San Francisco, 400 miles away, came purring into the phones. His dots and dashes mingled with those of N P K and I could read

*The position was north rather than "west," but the first message gave it as "west." The coast at this point runs northwest.

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began pounding. Too late the officers realized their error. No small boat could live in that seething expanse of waters now. Then came untiring lifesavers to the shore; a breeches buoy was rigged to the ship; but only through the sacrifice of four human lives. Four death-disdaining men attempted to take a line ashore in a frail little boat—and perished.

*Some of the wreckage of the Santa Rosa*

Slowly the passengers, drenched and shivering, were pulled ashore over the lifesavers' cable. Even before the last person left the doomed vessel, one of the great lines to the rescue ship, unable to stand the continual strain, snapped in two. Then the other line went, and a great foaming wave lifted the helpless Santa Rosa high in the air, and jammed her down again with a shuddering crash.

The vessel broke completely in two and the victorious, mocking sea rushed in between. The two sections did not sink entirely, but the waves broke over them where they lay fast aground. Miraculously, no more lives were lost.

The officers, heart-broken and silent, were the last to be taken ashore. Sadly the huddled group of survivors stood on shore and watched the cruel waters pull and tug at the ruins of the one-time queen of the sea. And as they watched, monarchial Nature ever triumphant over the works of man, called the shattered Santa Rosa to rest beneath the waters of the pitiless Pacific, there to join the bodies of those four heroes who perished that others might live.

## WIRELESS RATES LOWER THAN CABLE

In a recent issue of the Liverpool Journal of Commerce attention is called to what the Marconi Company is doing for commercial messages and a comparison is made with the cable companies. The article continues:

"The company has now taken up another enterprise, with a cheaper service to the West Indies, Bermuda, and British Guiana. The energy displayed by the company and its effects are far-reaching, and in this instance benefits are conferred on a part of the Empire which in the past has suffered more than any other owing to abnormal rates for telegrams. They may now be accepted between Great Britain and Ireland and Bermuda, Turk's Island, Jamaica, Antigua, St. Kitts, Dominica, St. Lucia, St. Vincent, Barbadoes, Grenada, Tobago, Trinidad, and British Guiana at 2s. 2d. per word for full rate and 1s. 1d. per word for deferred plain language telegrams, or 4d. and 2d. per word cheaper respectively than the rates charged by the cable companies. The above rates apply to messages in both directions, whether to or from the United Kingdom. St. Croix, St. Thomas, and Porto Rico can also be reached via the Marconi service at a reduction of 4d. per word, but messages at the deferred rate are not accepted for foreign islands as their respective Governments do not yet recognize this class of message. The Bahamas—Nassau—also benefits in this general reduction.

"The British and West Indian public will no doubt fully appreciate the possibility of effecting a further saving in their telegrams account, and will not fail to recognize the importance of the advantages secured to them by a concern endeavoring wherever its influence extends to introduce the lowest charges possible."

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# Echoing Our Advertising Man's "Are You a Subscriber?"

The members of our wireless club after due investigation of this and other publications label it our "official" magazine.

As a wireless magazine it contains more information than a half dozen of its contemporaries and information that is invaluable to the amateur and experimenter as well as the professional.

A. H., *Missouri.*

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THE WIRELESS AGE is "different." I have obtained more real information from it than from all the other wireless magazines combined. "Queries Answered" column has answered all of my questions for me by answering questions of others, and I have never voiced a question. H. D. S., *Connecticut.*

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I find in THE WIRELESS AGE much instruction and more pleasure than in any other magazine.

C. J. B., *Pennsylvania.*

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I find your magazine a very interesting one. It is smaller than others, but it contains many more useful articles.

L. E. K., *New York.*

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I have read many magazines, all of which have new inventions, but none are as up to date as THE WIRELESS AGE.

J. R., *California.*

---

Considering the benefit derived from this magazine, four months would be worth a year's subscription to any other. You have the best radio magazine published. E. G., *Ohio.*

---

THE WIRELESS AGE can't be beat. I am making a complete sending set from directions I have found in the last five issues. K. C., *Ohio.*

---

Your magazine is a pippin and has the other would-be wireless magazines skinned a mile.

J. M. H., *U. S. Govt. Service.*

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I have been interested in wireless for several years and in that time have subscribed to all the radio magazines that have come under my notice; one of them used to be a fairly good magazine, but success must have gone to its head, for it changed its character and left out the very thing that made it a success. It is now in oblivion as far as radio matters are concerned. I have secured more information from THE WIRELESS AGE than from any other source and would not part with my back numbers for anything.

F. C. M., *Louisiana.*

---

I will say right here that I am well pleased with THE WIRELESS AGE, not as a plaything, but as a useful instructor.

C. W. C., *Texas.*

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I had four months' trial subscription to THE WIRELESS AGE and was so pleased with it that I am lost without the magazine. F. C., *New York.*

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THE WIRELESS AGE has proved itself worthy of a large circulation, and it remains for its readers to show their appreciation of it by subscribing for it.

H. J. H., *California.*

---

I have been reading a friend's WIRELESS AGE, and simply cannot do without it. It is excellent, and I am sure of renewing my subscription four months from now.—R. S. B., *New York.*

---

My subscription to THE WIRELESS AGE expired with the July issue. I have been taking it for one year and wish to say right here that I think it is the most up-to-date and covers the wireless subject the most thoroughly of any magazine published to-day. Of course the above does not amount to much with you people, as you get many letters such as this every day, but nevertheless I think that there are many over the country that will back up this statement of mine.—L. K., *Oregon.*



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# RADIO RAVINGS

*Conducted by D. Phecriff Instater*

A brand new and suitably inscribed Government license certificate rustled expectantly against three clean collars and a handkerchief reposing lonesomely in the grip he carried. Fresh from the Marconi School, the new operator dashed up the gang plank. It was early, but the Old Man was on board. The new op. reported at his cabin.

"So you are my new wireless, eh?" began the captain, kindly. "What's your name?"

The abashed young man murmured incoherently.

"What's that?" said the Supreme Being. "I didn't catch that name. Spell it."

Young Hopeful began: "O, double T, I, double U, E, double L, double——"

"Wait!" gasped the captain. "Begin again!"

He repeated: "O, double T, I, double U, E, double L, double U, double O——"

"Whoa!" bellowed the captain. He glowered uncertainly; then: "What do you think you're doing, kidding me? Cut the comedy. What is your name?"

"My name," spluttered the abashed one, "is Ottiwell Wood, and I spell it O, double T, I, double U, E, double L, double U, double O, D."

---

It's one of those well-worn bromidic murmurs, of course, but there's a lot in that what's-in-a-name thing.

Down in South America, so an operator has told me, the populace became greatly excited over Caruso's visit and the higher opera. They tried to make a national hero out of him, but he wouldn't have it. He ducked the idol proposition all along the line and kept out of sight as much as possible.

One afternoon he was riding with a companion along an unfrequented beach road and came upon a wireless station. It reminded him that one of his dear friends was approaching over the ocean and he stopped to send a message of greeting. As he wrote out the blank the native operator gazed at him curiously; for it was quite evident from his companion's manner that the stout, jolly visitor was a very great personage, indeed.

When the writer had finished the operator took up the blank, glanced through it and remarked: "You have omitted the signature. What name shall I sign?"

"Oh," said the opera star, "my name's Caruso."

The operator stared. "Great heavens!" he gasped. "Robinson Caruso, the great traveler! Little did I ever expect——"

But a huge guffaw from the million dollar throat interrupted the effusion right there.

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**Feministically Speaking**

Cape of Good Hope—Sweet sixteen.
Cape Flattery—Twenty.
Cape Lookout—Twenty-five.
Cape Fear—Thirty.
Cape Farewell—Forty.

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Identification lacking in this case:

"How do you like your new junior?"

"Fine! He's a good kid; don't know no more about grammar, spellin' and punctuation than I do; he's just out 'er college."

Upon glimpsing which, Harold reiterates that life holds more joyous pastimes than reading P Vs.

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What a nice, peaceful world this would be if it wasn't for the movements of the human under-jaw.

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To put it acrostically, our unfortunate brethern across the seas need some one individual who measures up in:

**W**atchfulness
**I**ndependence
**L**earning
**S**agacity
**O**ptimism
**N**erve.

---

That's all.


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# Marconi Men

## The Gossip of the Divisions

### Eastern Division

H. E. Cohen has relieved C. B. Darcy on the Bantu.

C. R. Underhill has relieved Charles Murray as junior on the Mexico. Murray is on leave.

O. M. Eddey is junior on the San Jacinto.

R. Voelker is junior on the El Occidente.

The cable ship Relay is again in commission. O. C. Temple and George Kavanagh are acting as first and second, respectively.

L. Brundage and Charles Heinline have been detailed to the Toyahashi Maru, a Japanese vessel. They expect to visit Japan and several European countries. Both anticipate an adventurous trip.

Irving Vermilya, formerly of the Sagaponack station, is at present detailed at Sea Gate.

M. Mendelsohn and J. F. Rodenbach are acting as senior and junior, respectively, on the Coamo.

Fred Klingenschmidt is attached to the Montgomery. Giles is junior.

F. Lumea has been promoted, being senior on the Algonquin.

Louis Michael is first on the Northland.

C. L. Whitney has been re-engaged. He is at present attached to the El Norte.

L. S. White, operator at Sagaponack, has been detailed to the Construction Department in New York.

P. H. Krieger has been detailed as junior on the Arapahoe, relieving J. Maresea.

A. I. Yuter and G. I. Martin have been detailed to the Esperanza which went recently into commission.

A. Schweider and C. E. Stevens are on the Proteus as senior and junior.

L. C. Nunn is now senior on the Sabine.

P. H. Nisley recently returned from leave of absence. He is on the John D. Rockefeller.

Walter Tylar has been appointed senior on the Matura.

C. D. Riley is on the Buenaventura, a one-man ship.

J. P. Eckhardt has been re-assigned to the S. Y. Cassandra.

V. H. Rand, formerly of the Honolulan, is attached to the Saratoga as second. L. C. Driver is senior.

H. V. Griffing has returned from leave and is attached to the Brabant.

W. Stengle has relieved A. H. Randow on the Dakotan.

L. R. Schmitt has gone home on leave. K. H. See is on the Morro Castle as senior in his place.

W. Travers and Percy Harrison were assigned to the Comal when she went into commission recently.

C. C. Levin, of the Marconi School of Instruction, has been detailed as second on the Maracaibo.

A. Darlington and A. M. Currie are on the Parima.

M. E. Fultz succeeded J. K. Noble on the Seguranca when the latter resigned.

W. T. Little, a graduate of the Marconi School of Instruction, is junior on the Madison.

A. C. Olsen of the Y. M. C. A. School has been placed on the El Sol as second.

H. W. Blackstone is first on the Siberia.

F. J. Doherty is senior on the Jamestown. A. Armstrong, a tyro, is second.

P. S. Berryman, of the Marconi School of Instruction, is second on the City of Columbus.

Stanley Russell, who spent two months in jail at Newcastle-on-Tyne, for taking a photograph of a British warship within a restricted area, is returning on the Gulflight, which has been undergoing repairs at Shields, England. The Gulflight, it is expected, will soon return to the United States.

R. J. Green and D. A. Kell, the latter a graduate of the Marconi School of Instruction, have been assigned to the Mongolian, a newly-equipped vessel.

J. E. Doyle is now second on the Olinda.



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E. A. Bernstein, a new man, has been assigned as junior on the Northland.

S. J. Wright has returned from sick leave. He has been attached to the Iroquois.

E. Marschall is now senior on the Huron. H. E. Siegman is junior.

J. F. Rodenbach is junior on the Creole.

T. R. Bunting has resigned. P. Grasser takes the post vacated by him on the Princess Anne.

Harold Sachs has been re-engaged at San Francisco and is now junior on the Finland.

C. B. Darcy has been placed on the Alamo.

Matt Bergin, who served on the Camino of the Pacific Coast Division for a year, has been detached from that vessel and assigned to the El Occidente as senior.

D. Dudley has replaced W. S. Wilson on the Gulfcoast.

G. E. Entwistle is second operator on the Massachusetts. A. W. Mayer is on the Bay State.

N. W. Filson has been detailed on the Bunker Hill in place of F. C. Justice.

H. E. West, formerly of the Calvin Austin, has been detailed to the Governor Cobb.

G. S. Saunders has been detailed on the Nacoochee.

C. R. Crosby is at present attached to the J. M. Guffey.

### Great Lakes Divison

A. E. Jackson, superintendent of construction, has just completed a trip of inspection, including all the coast stations on the Great Lakes Division.

The season of wireless and navigation is slowly coming to an end on the Great Lakes for 1915. The older men on vessels which suspend navigation during the winter months are replacing these younger in the service on ships that have a longer schedule.

C. J. Hiller, relief operator of the State of Ohio, and R. Sidnell, of the Seeandbee, have replaced H. P. Roberts and D. Smith on the City of Detroit III as senior and junior, respectively. The State of Ohio and the Seeandbee have docked for the season.

C. D. Heinlen has been transferred from the Cleveland station to the steamship Juniata as senior, vice F. C. Goulding, who takes the City of Buffalo, a one-man ship.

H. C. Rodd, senior on the Octorara, has been transferred to the S. Y. Nokomis, vice C. Beals, who has resigned. G. M. Commerford has been assigned to the Octorara as senior.

The Northland has docked for the season. G. P. Aldridge, senior, is at school again, while E. Leonard, junior, has relieved James Coolidge as junior on the Octorara. Coolidge requested the relief as he became ill on the trip down from the upper lakes.

G. S. Mackwiz has been assigned to night duty at the Detroit station.

Operators C. K. Little and B. B. Minium, seniors on the North and South Americans, have resumed their studies at school, the vessels on which they were detailed having docked for the winter.

R. Mathews has replaced G. P. Derry on the Arizona. Mathews comes from the Chicago.

J. F. Weiss is now on the Puritan.

M. F. Kliepera, formerly on the Minnesota, is now on the Harvester, a one-man ship.

W. A. Hutchins, who was on the Wrecker Favorite, at the time she assisted in the raising of the Eastland, has again reported as fit for duty and has been assigned to the Indiana. Hutchins has been on sick leave.

A. F. Moranty, who was on night duty at Mackinac Island, has been assigned to the wrecker Favorite. E. A. Johnson, of Chicago, has been detailed at Mackinac Island in place of Moranty.

R. Mathews has been detailed to the Arizona in place of G. P. Derry.

### Southern Division

E. P. Diggins has been assigned to the Ontario as junior operator, Kelland having been transferred to the Baltimore station for several weeks. Junior Operator J. H. McCauley was appointed senior operator on the Ontario.

Assistant Operator Graf of the Baltimore station was recently assigned to the Howard as senior operator for one trip to Boston in place of L. E. Bell.

W. E. Neumann recently joined the

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Gloucester as junior operator, relieving Operator F. H. Crone, who is on sick leave.

Operator V. Zito has been assigned to the Somerset as junior operator, in place of C. H. Warner, who has been assigned to the Christian Knudson at Newport News, Va.

L. W. McKee, who has been on relief duty at the Baltimore station, has been assigned to the Nantucket as senior operator, vice Operator Vogel, the latter being temporarily absent from duty.

J. F. Larrimore was recently assigned to the Nantucket as junior operator in place of Operator Simons.

R. P. Linderborn of the Merrimack is the proud father of a baby girl.

### Pacific Coast Division

C. M. Jackson has been promoted to wireless operator in charge and purser of the Aroline.

J. G. Kelly, who has been absent from duty because of illness, has been assigned as assistant on the Aroline.

The following Marconi men have returned from the Alaska Packers' Canneries: S. Gaskey, P. M. Proudfoot, W. J. Erich, L. W. Sturdivant and C. A. R. Lindh.

S. A. Hodges has joined the Bear as assistant.

F. M. Gill was recently assigned to the Cabrillo at East San Pedro.

H. W. Dickow and E. K. Hawkins are now acting as first and assistant on the Congress.

William Jefferson Slattery, formerly of the San Francisco messenger force, has been assigned as assistant on the Celino.

L. D. Payne has been detailed on the Coronado.

T. I. Atwood and L. Winser are acting first and assistant on the City of Topeka.

M. W. Michael and J. L. Slater are on the City of Puebla as first and assistant.

E. R. Riddle has joined the Grace Dollar.

P. E. Riese and W. R. Lindsay have been assigned as first and assistant on the Governor.

D. W. Kennedy has joined the Great Northern as assistant.

W. R. Barsby was recently assigned as operator of the Honolulan at New York. He will be transferred to the high power circuit on his arrival in San Francisco.

C. Bentley has been assigned to the Hilonian as assistant, relieving F. Deckard, resigned.

C. H. Rogatsky and S. J. Richardson are now acting first and assistant of the Klamath.

H. A. Fowler has been assigned to the F. A. Kilburn as assistant.

N. McGovern and J. E. Echlin have joined the Lurline as first and assistant.

T. A. Churchill has been transferred to the Mongolia as assistant.

F. A. Lafferty and R. F. Harvey are now first and assistant, respectively, on the Matsonia.

H. G. Austin has been assigned as assistant on the Manoa.

G. B. Ferguson recently relieved R. P. Woodford as operator of the Navajo. Operator Woodford was transferred to the high power circuit.

E. M. Sutton has relieved O. Mock as operator in charge of the Northland.

J. M. Chapple has been transferred to the Pennsylvania.

C. A. R. Lindh has been assigned to the President as assistant.

P. M. Proudfoot was recently assigned as operator in charge of the Queen.

B. H. Linden recently joined the Rose City, having been assigned temporarily as assistant.

J. A. Wilson and P. D. Allen are first and assistant on the Roanoke.

A. W. Peterson has relieved F. W. Shaw as station manager for a period of two weeks. R. Johnstone and E. T. Jorgensen are employed on the second and third tricks respectively.

I. W. Hubbard and H. Grundell have been detailed as acting first and assistant on the San Juan.

J. E. Johnson and H. W. Kelley were recently assigned as first and assistant on the Umatilla.

P. E. White has joined the Willamette as operator in charge.

E. D. Bryant was recently assigned in charge of the Wilhelmina.

A. H. Doty recently joined the Wapama as assistant.

F. W. Brown has been assigned to the Yucatan.

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### Seattle Staff Changes

William Christenson, who has been on leave, has returned to duty at the Seattle station.

L. A. Lovejoy of the Astoria Marine station, has been assigned to the new high power station at Astoria.

R. S. Powell of the Seattle Shop Construction Department has been assigned to the new high power station at Ketchikan, Alaska.

W. J. Manahan of the Seattle Shop Construction Department has been assigned to the Juneau high power station.

H. W. Barker, who has been acting as assistant engineer at the Astoria high power station, has been transferred to the Seattle Construction Department.

H. L. Edling has been assigned to the Astoria marine station.

W. B. Wilson has been assigned to the Seattle station.

J. A. Marriott, who has been first operator on the Congress, has been assigned to the Juneau station.

E. K. Hawkins, a new man, has been assigned as second operator on the Congress.

A. P. Nielson, second operator on the City of Seattle, has been appointed first on the Humboldt.

J. R. Moore has been assigned to the City of Seattle.

R. E. Cowden, first on the Humboldt, has been assigned to the new high power station at Ketchikan.

R. V. Harris of the Seattle station has been transferred to the Seattle office.

F. M. Roy, first on the Senator, has been transferred to the new high power station at Astoria.

R. A. Billadeau has been assigned as assistant operator on the Senator.

E. Lee of the Mills has been transferred to the Alliance. A. G. Simson of the Alliance has been transferred to the tanker Mills.

N. C. Kumler of the Alki has been transferred to the Humboldt as assistant operator.

G. C. Hallet has been assigned as assistant operator on the Alki.

J. N. MacGowan of the Pavlof has been transferred to the City of Seattle.

W. J. Sunderland, a former member of the force here, has been appointed city manager at Juneau.

J. A. Stirling, formerly of the President, took up G. A. Meade's duties at the Y. M. C. A. School while the latter was on a vacation.

B. C. Springer, formerly of the Windber, has been transferred to the Spokane as first operator.

I. F. Julien has been appointed manager of the Astoria high power station.

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## RELIEF BY WIRELESS

A wireless call for a surgeon sent out by a Marconi operator on the steamship John A. Hooper, in the Caribbean Sea, brought medical aid to Miss Annie Christiansen, a passenger, who, during a severe storm fell to the floor of her stateroom, sustaining a fractured leg. Aid was rendered by the surgeon on the steamship Alliancia, which, although thirty-five miles away, responded and the sufferer was given attention.

The doctor, however, recommended that the patient be sent to the nearest hospital which was at Kingston, Jamaica, where Miss Christiansen was taken. She is a sister of one of the owners of the vessel.

## HAMMOND TALKS ABOUT SUBMARINE WIRELESS

John Hays Hammond, Jr., inventor of the wireless controlled torpedo, fired from shore and recommended for purchase by the government, recently discussed with Secretary of the Navy Daniels a plan for a similar device for torpedoes fired from submarines. Many torpedoes fired by submarines or destroyers never reach their mark. Mr. Hammond told Secretary Daniels he believed he had found a means by which the deadly missiles would be guided to their mark unfailingly.

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The Marconi Company has placed a phonograph and a large supply of records in the Cape Hatteras station for the use of the operators at that station.

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# Queries Answered

**Answers will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all letters and only one side of the paper written on; where diagrams are necessary they must be on a separate sheet and drawn with India ink. Not more than five questions of an individual can be answered. To receive attention these rules must be rigidly observed.**

## Positively no Questions Answered by Mail

E. O. K., Lebanon, Pa., writes:

Ques.—(1) What is the natural wave-length of my aerial which consists of four aluminum wires spaced 3 feet apart, length 125 feet, height 60 feet at one end and 35 feet at the other end?

Ans.—(1) The natural wave-length of this antenna is about 310 meters.

Ques.—(2) Please give a diagram of connections for a buzzer tester to be used in connection with a galena detector.

Ans.—(2) Note the diagram of connections (Fig. 1). A buzzer is connected in series with an inductance coil, L, and a battery, B, the coil, L, being placed in inductive relation to the coil, L', of the antenna system. In this manner the antenna is set into excitation by impulses from the buzzer circuit and will be excited at its own time period of vibration. If the secondary circuit of the receiving tuner is in resonance with the antenna system the maximum strength of signals will be received when the crystalline detector is properly adjusted.

Ques.—(3) What advantage is gained in receiving by having a variable condenser connected in series with the earth lead?

Ans.—(3) A series condenser in the antenna system is sometimes necessary when the natural wave-length of the antenna is greater than the emitted wave of a distant transmitting station. In this case it has the effect of decreasing the natural period. By judicious use of a variable condenser in the antenna circuit the decrement of damping of the antenna system may be decreased, the energy from interfering stations being eliminated as a consequence. Generally, however, decreased strength of signals is experienced when the variable condenser is not required for purposes of resonance.

Ans.—(4) A series condenser in the receiving antenna system generally does not have a paper dielectric. A variable air condenser should be employed. Its maximum value of capacity need not be more than .001 microfarad.

Ques.—(5) In the construction of a loading coil what is the best method for removing the insulation from the wires for a slider?

Ans.—(5) The best method is to remove the wire by means of a sharp pointed knife.

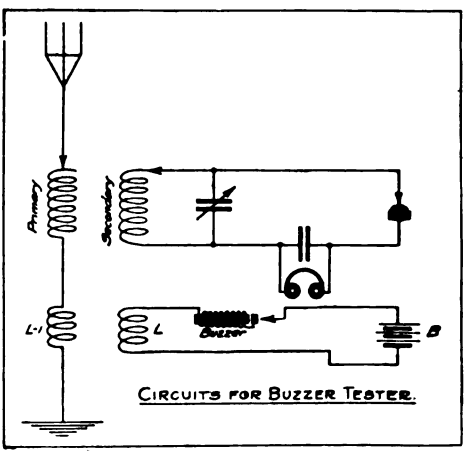
* * *

J. M., Philadelphia, Pa., inquires:

Ques.—(1) What is the interpretation of the following Arlington signals sent immediately after the baseball scores and the time signals, such as:

— . — . —
. — — . . . — — . —
. . . — — . —

Ans.—(1) The first signal, KA, is the international attention call. The following signal, ASTA, means "all stations attention," and the third signal, SK, is the international signal



CIRCUITS FOR BUZZER TESTER.

*Fig. 1*

for the complete termination of business.

Ques.—(2) Please tell me how many sections of Murdock molded condensers (.0017 microfarad per section) connected in parallel should be used in connection with the following transmitter: ¼ k.w. transformer, secondary voltage 5,000 volts; helix consisting of 12 turns of No. 8 brass wire on a form 8 inches in diameter; rotary spark gap giving 240 sparks per second, and an aerial 40 feet in length by 56 feet in height at one end; wire spaced 1¼ feet.

Ans.—(2) The voltage of this transformer is rather low for satisfactory operation at a wave-length of 200 meters. The maximum value of capacity which you can employ is .01 microfarad. This will allow, if short connections are used, one turn of wire at the primary winding of the oscillation trans-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former. A condenser of this size is not exactly suited for the secondary voltage of your transformer, but it is the best that can be done in the circumstances. You will secure increased results by purchase of a high voltage transformer giving 15,000 volts. You require six Murdock condensers in parallel for the designated capacity.

Ques.—(3) What is the wave-length of the aerial?

Ans.—(3) The natural wave-length of this antenna is between 160 and 170 meters.

Ques.—(4) Do you think a ground wire consisting of twenty-one strands of No. 22 B. & S. copper wire twisted together and having a length of about 25 feet will have any effect on the sending radius.

Ans.—(4) Offhand, we should say that this cable will have sufficient current-carrying capacity for the output of your set.

Ques.—(5) Please give dimensions for a quenched gap, such as the size of the plates, number of plates and the material of which they are made for use in connection with above transmitter. Where can I purchase plates for a quenched gap and what is the approximate cost?

Ans.—(5) We cannot give the complete mechanical details in this department for the construction of a satisfactory quenched gap. You can purchase plates of this type from the Cost and Sales Department of the Marconi Wireless Telegraph Company of America, 233 Broadway, New York. These plates are made of copper, carefully ground, so as to have absolutely even surfaces. For use in connection with the transformer of the voltage described you would require no more than five plates. These plates should be separated by micanite or fibre washers having a thickness of about 1/50 of an inch so that when pressed together the plates will not be separated by more than 1/100 of an inch. For your purpose the over-all dimensions of a plate for the quenched gap should be four inches, that is to say, 4 inches in diameter. One-half inch from the outer edge there should be a groove cut in the plate ¼ of an inch in width and about 3/16 of an inch in depth. There remains consequently a sparking surface in the center of 2½ inches. The plate should be ¼ of an inch in thickness, made of cast copper and, if possible, silver plated. The fibre washers for use between the plates should be 4¼ inches in diameter on the outside with a hole in the center of 2⅝ inches. The plates for the gap should then be piled up in a vertical or horizontal position and tightly pressed together by means of a set screw. See Fig. 2.

* * *

J. B. R., Albany, N. Y., inquires for information regarding the aluminum valve rectifier. He wishes to know the solutions used and asks for a diagram of connections for converting alternating current into direct current to charge a bank of storage cells.

Ans.—The aluminum valve rectifier contains an aluminum electrode and an iron electrode immersed in a neutral solution of ammonium phosphate. Occasionally sodium phosphate is employed. A diagram of connections for the use of this rectifier on alternating current for charging storage cells is shown in Fig. 3. A second diagram (Fig. 4) shows the connections for a two-way rectifier so that both halves of the alternating cycle may flow through the storage cell. In this type of rectifier the current is prevented from flowing in one direction on account of the production of a film of aluminum oxide at the aluminum terminal. However, if the pressure of the line is above 150 volts this rectifier will not function. Its practical limit in current carrying capacity is about twenty-five amperes.

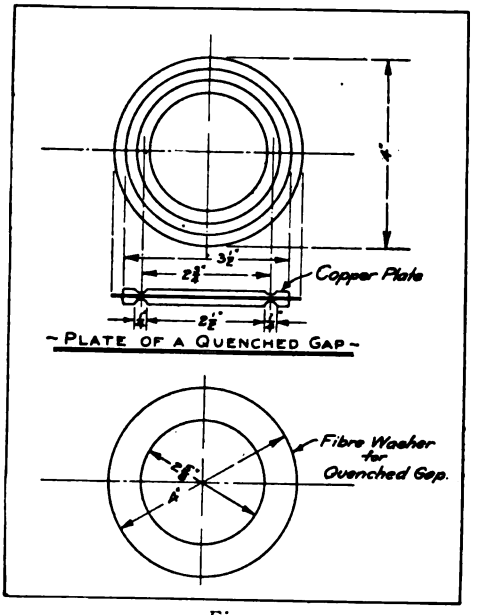


*Fig. 2*

In Fig. 4, L-1 and L-2 are impedance coils. The direction of current flow is indicated by the arrows.

* * *

J. E. D., Fort Aransas, Texas, inquires:

Ques.—(1) I have a number of pieces of hard rubber that I wish to remelt and mould into a form for a little experiment I am about to try out. I have tried various methods, but so far without success. I would be obliged if you would supply me with the necessary information, stating the materials required to accomplish the desired result.

Ans.—(1) The desired results may be obtained by crushing the hard rubber to a fine powdered state and mixing it with one-third of its weight of sulphur. Heat for several hours in a mould. The temperature at the start should be that of the room and should finally reach 300 degrees Fahrenheit. The sulphur is commonly added in a ground state,

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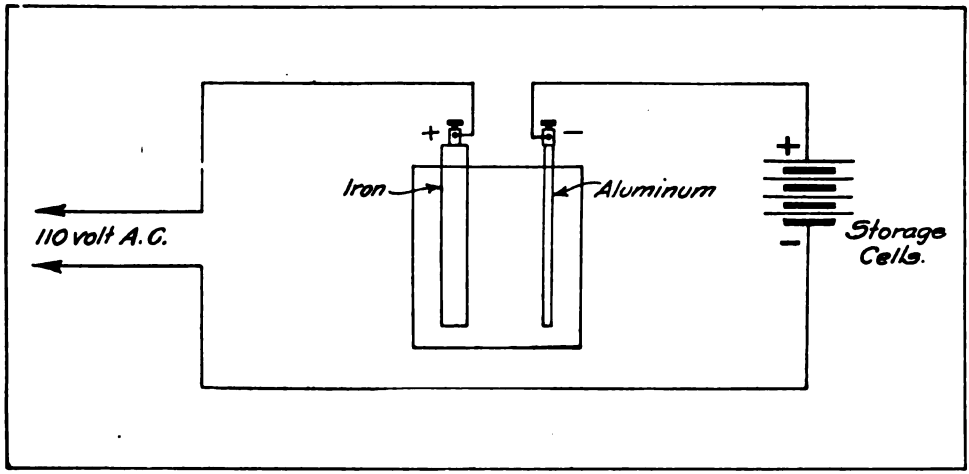


*Fig. 3*

but sometimes the India rubber is treated with some solution containing an element such as bisulphate of carbon. The inside of the mould should be dusted with pumice stone of lime so that the mixture will not adhere.

* * *

J. C. R., East Orange, N. J., writes that contrary to the opinion expressed on page 862 of the August issue of THE WIRELESS AGE in reply to E. M. T.'s inquiry concerning the reception of signals from Arlington with an indoor aerial, he has been able for a number of months to receive these signals with a flat top aerial consisting of seven wires, 21 feet in length, with a connection to the instrument 81 feet in length. He then describes the apparatus used which is of the ordinary construction and of about the proper dimensions for this work. The statement in the August issue was made because we considered E. M. T.'s aerial too small for adjustment to the emitted wave-length of the Arlington station. We did not wish to convey the impression that it was impossible to receive signals from Arlington under such conditions; in fact we believed it quite possible, as we stated, if the aerial had sufficient dimensions. It is at once evident that J. C. R.'s aerial has greater overall dimensions than that described by E. M. T. and consequently the signals are received.

It should be taken into account that it is possible to receive long distance signals with short aerials not entirely on account of the fact that the energy is being absorbed directly from the passing electro-magnetic wave by the small aerial, but also because this aerial may be in inductive relation to telephone or telegraph wires, or even power wires, which may pick up considerable energy from the Arlington station and re-radiate it into the smaller indoor aerial.

The strength of signals can be increased by using a triple vacuum valve amplifier. There is no doubt but that four wires, 100 feet in length, will give greater strength of signals than the present arrangement employed by J. C. R.

R. W. G., Oringsburg, Pa., inquires:

Ques.—(1) Please give directions for making a transmitting buzzer suitable for sending ten miles under poor weather and mountainous conditions?

Ans.—(1) It is very doubtful whether you will be able to cover ten miles with a transmitting buzzer unless a supersensitive receiving set, such as is obtained by use of the vacuum valve detector, is employed. The connections for a transmitting buzzer system are shown in full on page 802 of the August issue of THE WIRELESS AGE.

* * *

W. C. T., Scranton, Pa., inquires:

Ques.—(1) I have had considerable trouble with "kick backs" in the fixtures of our house when operating a ¼ k.w. transmitting set. I use a Murdock line protector connected across the primary circuit which is also grounded at the middle point, but whenever I transmit, a spark will jump in one or more of the fixtures. My transmitting set contains a 14,000 volt ¼ k.w. transformer, rotary gap, condensers and oscillation transformer. How can I remedy this trouble?

Ans.—(1) If the lighting wiring of your house is placed in iron conduit particular care should be taken to see that this conduit is properly connected to the earth. It may be possible that you have a poor earth connection for the transmitting apparatus proper and consequently considerable potentials are induced in the lighting circuits. If your transmitting aerial is so disposed that it is in close inductive relation to the power leads entering your house, there is no remedy for the difficulty except to place the antenna at right angles or, at a considerable expense, the incoming power leads may be placed in conduit under the earth.

Ques.—(2) I have heard that shellacking the coils of a receiving transformer affects its working. Is this correct?

Ans.—(2) Shellac applied to the coils of receiving apparatus has the effect of increas-

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ing the distributed capacity of the coils and, therefore, at certain wave-length adjustments may cause considerable loss of energy. However, in the average amateur apparatus this effect need not be taken into consideration. It is also well known that shellac has the property of absorbing considerable moisture and, consequently, may not afford the insulation expected.

The maximum wave-length of the antenna described in your third query is about 285 meters.

* * *

J. C. M., Bound Brook, N. J., inquires:

Ques.—(1) In the receiving transformer are the windings wound in the same or opposite direction?

Ans.—(1) It makes no difference. They may be wound in either direction.

Ques.—(2) When using a secondary loading coil, wound with No. 30 wire, in the receiving circuit is there any loss due to dead-ends when not using the complete coil?

Ans.—(2) Yes, the losses are considerable. They are greater than without the use of a secondary loading coil because of the increased value of inductance.

* * *

W. H., Chicago, Ill., inquires:

Ques.—(1) What are the dimensions for a 4-inch spark coil?

Ans.—(1) The primary coil should be 8¾ inches in length by 1 inch in diameter, composed of a bundle of fine iron wires. It should then be covered with three layers of empire cloth. The primary winding has 230 turns of No. 16 wire which is then covered with several layers of empire cloth or a small insulating tube. The secondary winding requires two pounds of No. 36 enameled wire made up into three sections, each having an approximate diameter of 4 inches. The condenser in shunt to the vibrator should have about 2,600 square inches of tin-foil.

Ans.—(2) You are apparently not familiar with the difference between a spark coil and a transformer. This device cannot be used as a step down transformer.

Ans.—(3) The secondary condenser for this coil should have a capacity of about .0025 microfarad. It may consist, therefore, of five glass plates 8 inches by 8 inches, covered with tin-foil, 6 inches by 6 inches. The plates should be connected in parallel.

Ans.—(4) With an aerial 50 feet in length by 40 feet in height you should be able to send a distance of from eight to fifteen miles, provided the receiving apparatus has sensitive apparatus.

Ans.—(5) We have no data regarding the new naval station at Lake Bluff, Ill.

* * *

F. C. M., New Orleans, La., inquires:

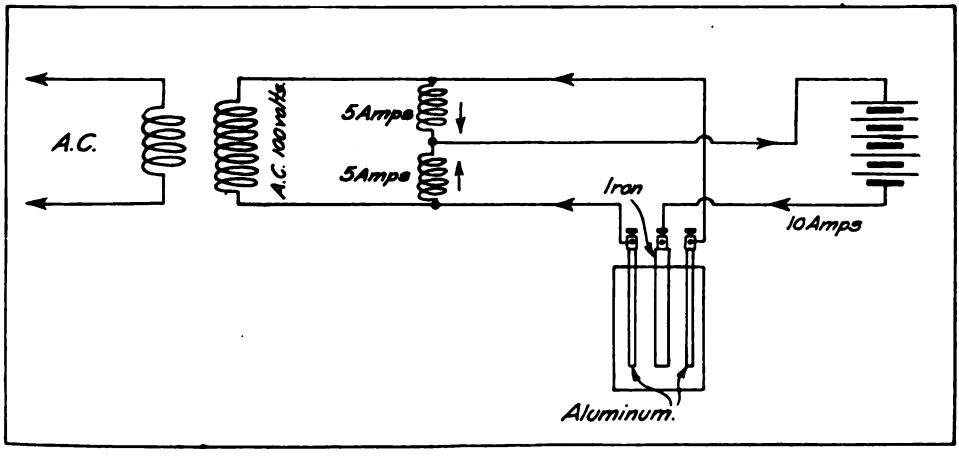


*Fig. 4*

Ques.—(1) By what formula can the approximate wave-length of an antenna be calculated?

Ans.—(1) See The Electrician for February, 1913. The matter is fully covered in an article by Dr. Cohen.

Ques.—(2) When constructing the secondary winding of a receiving transformer please tell me in what manner the approximate wave-length to which it will respond may be calculated, the size of the tube, the number of turns, etc., being known?

Ans.—(2) We cannot treat the subject exhaustively in this department. You should first decide the type of detector with which this apparatus is to be employed. If it is to be used with a vacuum valve detector, which requires a maximum value of potential for the best results, the capacity in shunt to the secondary winding should be very small, not over .0002 microfarad. Having decided upon the capacity of this condenser and the range of wave-lengths to which the receiving transformer is to respond, we can use the following formula to calculate the value of inductance for the secondary coil, namely:

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$$L = \frac{\lambda^2}{3552\ C}$$

Where L = the inductance value in centimeters.
$\lambda$ = the wave length in meters.
C = the capacity of the condenser in microfarads.

When the value of inductance has thus been determined you can refer to the article appearing on page 843 of the August issue of THE WIRELESS AGE in which full instructions are given for the rapid calculation of the inductance of a single layered coil and also for calculating the number of turns required to obtain a given value of inductance.

Ans.—(3) By use of the circuits described beats will be produced in the local circuit of the vacuum valve, provided the inductance coil connected in series with the plate of the valve has sufficient value. Secure a copy of United States Patent No. 1,113,149.

Ques.—(4) Where can cardboard tubes be secured?

Ans.(4) Communicate with Ware & Company, Watt street, New York City.

Ans.—(5) We have no record of the call letters referred to. We believe they have not been assigned, with the exception of those for the Santa Maria, which are KLG.

Ans.—(3) A variable condenser is not absolutely necessary, provided the receiving apparatus has sufficient inductance value to allow resonance to be maintained with a distant transmitting station. It is quite desirable for tuning purposes to have one in shunt to the secondary winding and another in series with the antenna system for obtaining short wave-lengths. But for the average amateur work about the city receiving apparatus which will do away with the necessity for a variable condenser can be designed.

* * *

E. H. G., Lenark, Ill., inquires:

Ques.—(1) I have two aerial wires, one consisting of two No. 14 copper wires 114 feet in length, spaced 2 feet apart, and another of 4 aluminum wires, 48 feet in length, spaced 2 feet apart. Each aerial is 50 feet in height at one end and 30 feet at the other, with a lead-in of 10 feet. What is the wave-length of each aerial?

Ans.—(1) The natural wave-length of the first described aerial is 275 meters, while that of the second is about 160 meters.

Ques.—(2) Should I use both aerials in sending for a distance of twenty miles, or would it be preferable to use only one?

Ans.—(2) For covering a distance of twenty miles, we should prefer the antenna having a wave-length of 275 meters.

Ques.—(3) The nearest station to me is nineteen miles. What size spark coil should I use with dry cells to work with this station under the most favorable conditions?

Ans.—(3) We recommend that a 10-inch spark coil be used for this distance in order to insure sufficient strength of signals to be read under all conditions. Coils of this type may be purchased from the Cost and Sales Department of the Marconi Wireless Telegraph Company of America. It is more satisfactory to operate a spark coil from storage cells than from dry cells. A 10-inch spark coil generally requires about twenty volts in a primary winding and if you insist on using dry cells, we recommend that you connect twenty cells in series and another set of twenty cells in series, and then connect the two sets in parallel.

Ans.—(4) With the apparatus you describe you will not be able to receive the signals from Arlington in daylight unless you employ a triple vacuum valve amplifier, as described in the January, 1914, issue of THE WIRELESS AGE. We have examined the diagram of connections which accompanied your communication and advise that you eliminate one of the fixed condensers. You virtually have two fixed condensers connected in series, one being connected in series with one terminal of the secondary winding and the other in shunt to the head telephones. Eliminate the first named condenser and you will receive better signals. Note the diagram of connections on page 743 of the July issue of THE WIRELESS AGE. This is the most efficient method of connection which can be devised.

* * *

R. E. R., Seattle, Wash.:

Your communication is too long to be published in full in these columns. The natural wave-length of your antenna is 200 meters and the capacity about .00026 microfarad. The receiving apparatus you describe will allow adjustment to wave-lengths of about 2,400 meters.

We cannot give you the dimensions of an oscillation transformer for this set to operate at a wave-length of 200 meters, as you request in your fourth query, because we do not know the capacity of the condenser employed in the spark gap circuit. Inasmuch as the antenna has a natural wave-length of 200 meters you require a series condenser in the antenna circuit in order that the wave-length may be reduced sufficiently to allow a few turns to be inserted in series with the antenna system at the secondary winding of the oscillation transformer. Such a condenser should have a capacity value of about .005 microfarad. A single plate of glass, 8 inches by 8 inches, covered with tin-foil, 6 inches by 6 inches, the glass having a thickness of about 1/8 of an inch, will give a condenser this capacity. We advise, however, that you avoid the use of a short wave condenser and reduce the size of your transmitting aerial so that it will have a natural wave-length of about 170 meters. This will allow a few turns of wire to be inserted at the secondary winding of the oscillation transformer until a wave-length of 200 meters is obtained. An antenna, 60 feet in length by 30 feet in height, will have a natural wave-length of about 162 meters, or an aerial, 40 feet in height by 50 feet in length, will have a similar wave-length.

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W. E. R., St. Louis, Mo., inquires:

Ques.—(1) I have observed in some of the larger manufactured receiving sets, a single pole, double throw switch which throws the primary condenser either in the ground circuit or across the primary winding of the receiving transformer. I should like to know in what manner this is connected up.

Ans.—(1) On investigation it will probably be found that while this switch may apparently be a single pole, double throw, it is fitted with auxiliary contacts which permit such connections to be made. It is impossible to throw the condenser in series with the antenna system or in shunt to the primary winding by means of a simple single pole, double throw switch.

Ques.—(2) I have heard that pieces of carbon are often connected across the 110-volt A. C. line and grounded at the middle point, being employed for the purpose of eliminating electrostatic induction. Can this be done and if so, what should be the resistance of the rod?

Ans.—(2) You are quite correct in your belief that they are so employed. Generally these rods consist of graphite about 6 inches in length by ½ inch to ¾ of an inch in diameter. The resistance value is between 5,000 and 15,000 ohms. Rods of this type may be purchased from the Cost and Sales Department of the Marconi Wireless Telegraph Company of America.

* * *

C. N. R., Lowell, Mass., inquires:

Ques.—(1) Please tell me through your valuable magazine the wave-length and capacity of my aerial. It is of the inverted L type, 50 feet in length and 35 feet in height, comprising 8 wires of No. 16 B & S gauge copper. The ground wire is 40 feet in length and the lead-in 50 feet.

Ans.—(1) The natural wave-length of this antenna is about 175 meters and the capacity .00031 microfarad.

* * *

J. J. H., Philadelphia, apparently has taken the Government license examination, or at least intends to do so. He inquires:

Ques.—(1) How would you test for an open circuit or a short circuit between the primary and the core of an induction coil?

Ans.—(1) A 16 c.p. lamp should be connected in series with 110-volt, direct or alternating current circuit. One terminal of this test circuit should be connected to the core and the other to the primary winding. If there is a short circuit between the primary winding and the coil the lamp will, of course, glow at practically full brilliancy. If there is no short circuit, the light will not glow.

* * *

Ques.—(2) Please tell me the correct answer to the question, Why do we plot a resonance curve?

Ans.—(2) A resonance curve shows in a general way the distribution of energy in a wireless telegraph transmitting system and allows an approximate calculation of the amount of interference to be expected from a given wireless telegraph transmitter. Properly plotted, a resonance curve allows the logarithmic decrement of damping to be calculated. It also shows whether the emitted wave is pure and in compliance with the United States restrictions.

Ques.—(3) Would the inability to draw a spark where the ground lead is sodded or bolted to the hull deck or water pipes be sufficient proof that the antenna system is properly grounded

Ans.—(3) A better test could not be devised.

Ques.—(4) If all the leyden jars in a transmitting set were broken would the arrangement shown in the diagram enclosed be practical, or would better results be obtained by using a plain aerial hook-up?

Ans.—(4) If all the leyden jars were broken the plain aerial connection is by all means preferable. The temporary condenser shown in your drawing is feasible and will give results, provided you can locate a jar aboard a vessel which is water tight. Questions of this nature are fully answered in the book "How to Pass the U. S. Government Wireless License Examination" on sale by the Marconi Publishing Corporation, 450 Fourth Avenue, New York.

* * *

E. W. D., New York City:

The receiving aerial, having dimensions of 50 by 55 feet, will allow the adjustment of wave-lengths up to and including 1,500 meters. We do not recommend that the secondary winding of the receiving tuner be wound with No. 40 enameled wire. It is too fine. Your daylight receiving range is about 150 miles and your night range probably 500 or 600.

* * *

G. D. C., Bessemer, Ala.:

As previously stated in the columns of this department, call bell apparatus for wireless telegraph systems have been devised, but the apparatus is exceedingly complicated and expensive, being far beyond the average amateur's pocketbook. Apparatus of this type is not entirely practicable for the reason that the bell will ring constantly when atmospheric electricity is severe. Apparatus of this type generally includes a vacuum valve amplifier and a sensitive polarized relay or a microphonic relay in connection with a sensitive polarized relay. We cannot devote space in these columns to a complete description of such equipment.

* * *

A. T. D., Clyde, N. Y.:

We cannot answer questions in this department by mail. Replies must appear in these columns. We cannot give you definite advice as to efficiency of various amateur apparatus supplied by manufacturers, particularly in this instance, because we are sure from your communication that you are not certain from which stations you desire to receive. You refer to certain high power stations, but unless we know definitely the range of wave-lengths over which you expect to work, we cannot give advice. It is not practical to construct a receiving tuner which will have a range of

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wave-length from 200 to 10,000 meters. It is preferable that the receiving apparatus be divided up into separate units, each one of which has a lower range of wave-lengths. For example: It is practical to construct a receiving tuner which will have a range of from 200 to 1,800 meters and also a second one which will have a range of, say, from 1,500 to 5,000 meters. A third tuner having a range of from 5,000 to 10,000 meters should then be constructed. In previous issues of THE WIRELESS AGE, particularly in the series "How to Conduct a Radio Club," apparatus of this kind has been described. Make sure of the stations from which you desire to receive, ascertain their wave-length and you will be able to decide for yourself what type of apparatus should be used.

* * *

H. M. R., Jasper, Mo.:

Ans.—(1) In reference to fastening a phonograph horn to a telephone receiver: unscrew the cap and have it threaded; then fit to it a small brass tube securely held in place by threading it. A small rubber hose should connect the tube to the phonograph horn.

Questions concerning wire telephony will not be answered in this department.

* * *

R. M. A., Chicago, Ill., inquires:

Ques.—(1) I should like to have a formula for changing microhenries to centimeters in the inductance of a single-layered coil.

Ans.—(1) One thousand centimeters of inductance is the equivalent of 1 microhenry.

Ques.—(2) Please give me a formula for changing the capacity of a condenser in centimeters to the capacity of microfarads.

Ans.—(2) Divide the capacity in centimeters by 900,000.

Ques.—(3) Should the wires in the secondary of a loading coil be of the same size as those in the primary winding of a loading coil in order to obtain resonance?

Ans.—(3) Not necessarily. Generally a loading coil in the secondary winding has the same sized wire as is used at the secondary winding itself.

Ques.—(4) Will the Marconi Company sell one of its standard variable condensers? What would be the price?

Ans.—(4) Communicate with the Cost and Sales Department of the Marconi Wireless Telegraph Company of America, 233 Broadway, New York.

Oues.—(5) Where can I get a wave-meter calibrated and what would be the cost?

Ans.—(5) Communicate with the Engineering Department of the Marconi Wireless Telegraph Company of America, 233 Broadway, New York.

* * *

J. J. C., Brooklyn, N. Y., asks:

Ques.—(1) How many batteries are required to send 10 miles on a 1½-inch spark coil? Will a condenser assist in covering this distance, and what should be its dimensions?

Ans.—(1) The average 1½-inch spark coil requires about eight volts of potential. You therefore need six dry cells connected in series. It is preferable to use two sets of six each in series and then connected in parallel in order that the life of the batteries may be prolonged. With coils of this size we have found by experiment that better distances are covered when the spark gap is connected directly in series with the antenna system, eliminating the oscillation transformer and condenser. But if your station is located within the zone of commercial or naval interference you will not be allowed to use this arrangement. A condenser for a 1½-inch spark coil must have a very small value of capacity, not more than .0005 microfarad. A single plate of glass, 8 inches by 8 inches, covered with tin-foil, 6 inches by 6 inches, the glass being ⅛ of an inch in thickness, will give a capacity of about this value.

Ques.—(2) I have a receiving transformer with a primary 8 inches in length by 4½ inches in diameter, wound with No. 24 S. S. C. wire. The secondary winding is 8 inches in length by 3¼ inches in diameter, wound with No. 30 S. S. C wire. To what wave-length can I adjust?

Ans.—(2) The secondary winding of this coil has an inductance of about 4,236 microhenries. If the secondary winding is shunted by a variable condenser of .001 microfarad the wave-length of that circuit will be adjustable to about 4,000 meters. Without the use of a variable condenser in shunt to the secondary winding, wave-lengths of between 2,000 and 2,400 meters will be received.

* * *

J. A. M., Yonkers, N. Y., inquires:

Ques.—(1) Please give me a formula for the calculation of inductance of a multi-layered coil.

Ans.—(1)

$$L = 4\pi^2 n^2 m \left\{ \frac{2 a_0^4 + a_0^2 l^2}{\sqrt{a_0^2 + l^2}} \right\} + 8\pi^2 N^2 \left\{ \left[ (m-1) a^2 + (m-2) a_2^2 + \ldots \right] \left[ \sqrt{a_1^2 + l^2} - \frac{7}{8} a_1 \right] + \frac{1}{2} \left[ m(m-1) a_1^2 + (m-1)(m-2) a_2^2 + (m-2)(m-3) a_3^2 + \ldots \right] \left[ \frac{a_1 r_1}{\sqrt{a_1^2 + l^2}} - r \right] \right\}$$

where m = the number of layers.

a = the mean radius of the solenoid.

a-1, a-2 and a-3 = the mean radius of the various layers.

l = the length of the solenoid.

r = the radial distance between two consecutive layers.

n = the number of turns per unit length,

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All of these dimensions are in centimeters. This formula was given by Cohen and is said to be accurate within ½ of 1 per cent., the accuracy increasing as the length of the coil in relation to its diameter increases.

* * *

G. W. M., Fulton, N. Y.:

There appeared on page 743 of the July, 1915, issue of THE WIRELESS AGE, a diagram of connections for use in connection with crystalline detectors. This diagram is the most efficient yet devised and is recommended for your use.

We cannot calculate the range of wave-lengths for a receiving tuner by merely knowing the number of turns in the primary and secondary windings. We must have the size of the wire, the length and diameter of the coils, etc.

The galena detector is far more sensitive than the electrotlytic, that is, when its operation and adjustment is properly understood and it is employed in the correct circuits. The diagram of connections given on page 743 of the July, 1915, issue of THE WIRELESS AGE is applicable to the galena detector with the exception that the potentiometer and battery should be eliminated.

* * *

J. D., Mars, Pa.:

If you desire to purchase a magnetic detector, communicate with the Cost and Sales Department of the Marconi Wireless Telegraph Company of America, 233 Broadway, New York. While this detector requires no adjustment whatsoever, it is not sensitive on the lower range of wave-lengths. The best results are obtained on wave-lengths of between 2,000 and 3,000 meters. The magnetic detector cannot be used in the type of receiving tuner ordinarily employed by amateurs. It requires a special secondary winding of lower inductance value and also of lower resistance. The magnetic detector is used in connection with a 75-ohm head telephone. Data for the construction of the magnetic detector is not available for publication at this time.

* * *

C. H. S., St. Louis, Mo., asks for the best dimensions of a receiving tuner to be adjustable to a wave-length of 2,400 meters, to be employed in connection with a vacuum valve amplifier or crystalline detector. He also wishes to know the best size of wire to be used in both the primary and secondary winding.

Ans.—The primary winding of the transformer should be 4¾ inches in length by 4 inches in diameter, wound closely with No. 24 S. S. C. wire; the secondary winding should be 3⅜ inches in diameter by 5 inches in length, wound closely with No. 30 S. S. C. wire. The secondary winding may be shunted by a very small variable condenser. The turns of this winding should be divided between the points of a 10-point switch, while the primary winding should have a sliding contact or a multiple-point switch, as described in previous issues of THE WIRELESS AGE. The diagram of connections shown on page 743 of the July issue of THE WIRELESS AGE should be used.

* * *

C. B., Louisville, Ill., writes:

Ques.—(1) How far can I send under favorable conditions with a 12-inch spark coil, a fixed gap, condenser and oscillation transformer? This coil is to be operated on a 60 watt step down transformer with a wave-length of 600 meters.

Ans.—(1) If the receiving station is fitted with the proper apparatus you should be able to cover distances of from ten to fifteen miles.

Ans.—(2) The natural wave-length of the antenna described is about 490 meters. It is too long to be operated at a wave-length of 300 meters and requires a short wave condenser to be inserted in series for a wave-length of 450 meters. A few turns of inductance in the antenna circuit will raise the wave-length to 600 meters. We suggest that for operation on 300 meters you either decrease the length of this antenna or erect a second aerial of decreased dimensions. To be more explicit, for operation at a wave-length of 300 meters the natural wave-length of this second aerial may be less, say, about 250 meters. An aerial 40 feet in height by about 98 feet in length, consisting of four wires spaced 2 feet apart, will have a natural wave-length of 250 meters. A few turns of inductance connected in series will raise the wave-length to 300 meters.

The wave-length of the aerial described (490 meters) can be reduced to 450 meters by a condenser having a capacity of .0005 microfarad. Twelve plates of glass, 14 inches by 14 inches, covered with foil, 12 inches by 12 inches, and connected in series, will give a condenser of this capacity. The plates should be ⅛ of an inch in thickness.

Ques.—(3) Please tell me which of the following detectors is the most sensitive: Crystaloi, galena or silicon, and antimony.

Ans.—(3) The galena detector is said to be the most sensitive.

Ques.—(4) Please advise from what Government wireless stations the time signals and weather forecast are sent out. Last summer and autumn, and also during a part of the winter, I could hear Key West sending out the time signals at the same time as they were sent from Arlington, but for some months I have not been able to get the time signals from any station other than N A A and 9-ZS. Have some of these stations stopped sending time?

Ans.—(4) The following stations of the United States Naval Radio Service send out time signals daily:

| Stations. | Wave-Lengths in Meters. | When Sent. |
|---|---|---|
| Arlington... | 2,500 | Every day at 11:55 A. M. to noon and 9:55 to 10:00 P. M. standard time; 75th meridian. |
| Key West... | 1,000 | Daily at 11:55 A. M. to noon, standard time, 75th meridian. |
| New Orleans | 1,000 | Daily at 11:55 A M. to |

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| | | |
|---|---|---|
| | | noon, standard time, 75th meridian. |
| North Head. | 2,000 | Daily except Sundays and holidays at 11:55 A. M. to noon, standard time, 120th meridian. |
| Eureka ..... | 1,400 | Ditto. |
| San Diego .. | 2,000 | Ditto. |
| Mare Island. | 2,500 | Every day at 11:55 A. M. to noon and 9:55 to 10:00 P. M., standard time, 120th meridian. |

If, for any reason, the Arlington station is out of commission the time signal will be sent daily at noon, Sundays and holidays excepted, by the naval radio stations at Newport, New York, Norfolk and Charleston. The time is sent from the Naval Observatory, Washington, for the Atlantic Coast, and from the Observatory at the Mare Island Navy Yard for the Pacific Coast. A relay key in each station is connected to the Western Union lines by a relay at about ten minutes to twelve o'clock in the morning and the signals are made automatically direct from Washington and Mare Island.

Time signals from each of the observatories mentioned continue for the five minutes preceding noon and ten o'clock in the evening. During this interval every tick of the clock is transmitted except the 29th second of each minute, the last five seconds of each of the first four minutes, and finally the last ten seconds of the last minute. The noon and ten o'clock signal is a longer contact after this longer break.

Ques.—(5) For some reason I am unable to get many amateurs or commercial stations on 300 to 600 meters, although I am able to hear the high power stations at wave-lengths of from 1,000 to 3,000 meters whose signals come in loud and clear.

How can I arrange so that the short as well as the longer wave-length stations may be tuned in? Please give a diagram of connections.

Ans.—(5) Taking into account the aerial described, it is quite easy to understand why you do not receive the signals from amateur stations. The natural wave-length of this antenna is too great; in fact it is too long to be reduced to a wave-length of 200 meters by means of a series condenser. We advise that you erect a smaller aerial for receiving from commercial and amateur stations. An antenna 60 feet in length by 50 feet in height will allow the reception of amateur signals.

* * *

G. F. T., New York, inquires:

Ques.—(1) By employing an electric spark from a spark coil is it possible to eliminate all oxygen (leaving other gases present) from a small glass enclosure filled with air?

Ans.—(1) High potential current supplied through sealed-in electrodes will effect what you purpose.

Ques.—(2) Will the filament of an electric light bulb glow in a space from which all oxygen has been removed, other gases remaining present?

Ans.—(2) Yes.

Ques.—(3) What are the advantages of a compressed air condenser?

Ans.—(3) Self-restoring qualities of the dielectric in case an abnormal voltage is applied. Also the absence of dielectric losses.

Ques.—(4) Can you give me the address, street and number of W. N. T., listed as being located in New York?

Ans.—(4) This station is located at 90 West street, New York City.

Ques.—(5) Are the wing and grid of the vacuum valve all nickel or heavily plated?

Ans.—(5) They are made of solid nickel.

* * *

S. S., Stamford, Conn., asks for full data in reference to the construction of a magnetic detector. This information is not available at present.

Ques.—(2) At what time do Arlington and Sayville transmit with undamped oscillations?

Ans.—(2) The Arlington station may be heard between nine and half past nine o'clock at night, also at one o'clock in the morning. The undamped oscillation set is also used at other times of the day. The Sayville station can be heard directly after fifteen minutes after nine o'clock every evening. It operates on a wave-length of about 9,000 meters.

We cannot give the receiving range of your apparatus accurately, but offhand we should say that you will be able to hear signals from commercial stations at a distance of 1,200 miles at night and 200 miles in the day time.

* * *

J. L. R., Buffalo, N. Y., like many other amateurs at this season of the year, is having difficulty with long distance receiving. He says that he was able to hear the signals from the Arlington station during the winter months by the use of a vacuum valve detector, but during the summer months the signals completely disappeared, although they can still be read at other amateur stations in his vicinity on the ordinary mineral detectors. He encloses a diagram of connections, but fails to furnish us with complete data regarding the windings of the receiving tuner, the value of capacity of the condensers used in the various circuits, etc.

First, the variable condenser, in series with the secondary winding, should also be connected in series with the grid of the vacuum valve detector. The secondary winding should be so designed that for a given wave-length a very small value of capacity is used in shunt to the secondary winding. If the connections of the vacuum valve detector are correct and, furthermore, the bulb is at all sensitive, there should be no difficulty in receiving the signals from Arlington at Buffalo during the summer months. It may be that some of the batteries in a high potential set have become weakened or perhaps the vacuum valve is not sensitive. The data given is so incomplete we cannot reply further.

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# THE WIRELESS AGE

Owing to the fact that certain statements and expressions of opinion from correspondents and others appearing in these columns from time to time may be found to be the subject of controversy in scientific circles and in the courts, either now or in the future, and to sometimes involve questions of priority of invention and the comparative merits of apparatus employed in wireless signaling, the owners and publishers of this magazine positively and emphatically disclaim any privity or responsibility for any statements of opinion or partisan expressions if such should at any time appear herein.

NOVEMBER, 1915

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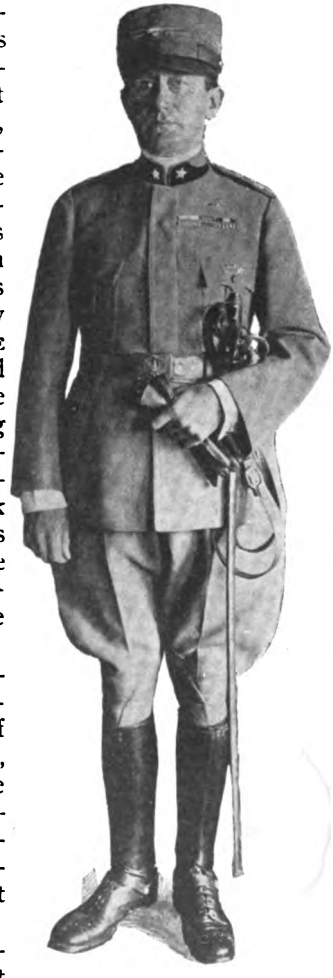
# The National Amateur Wireless Association

## Its Aims, Objects, Officers and Full Details of Operations and Plans, Given in an Address by the Acting President

ON the evening of October 28, members of the class in wireless telegraph instruction, East Side Branch, Y. M. C. A., New York, heard by special request details of the organization of the National Amateur Wireless Association, announced in the October issue of this magazine. J. Andrew White, editor of THE WIRELESS AGE, addressed the enthusiastic assemblage and immediately following his concluding remarks received voluntary assurances that active local work would be begun just as soon as the executives were ready to receive applications for membership. The address follows:

In introducing the subject of the creation of a nation-wide organization of amateur wireless workers, it is best to give first the whys and wherefores—cover with necessary brevity the reasons for this organization and just what it is expected to accomplish.



*Marconi in uniform as a lieutenant. This photograph was taken in London several weeks ago*

It seems hardly necessary to state that the great body of amateurs—fully 200,000 of them in this country—are not received with open arms either by government officials or individuals in private life. These young men have no champion, that is certain; attacks on their efforts are far more frequent than encouragement. Yet there must be something of value in the work they are doing. It may be advanced that nothing has been accomplished by the amateur; nothing, that is, of any material value to the world. Grant this, and who can come forward and say that the amateur of to-day is not the scientist of to-morrow? The merest tinker may develop into an enthusiast, take a technical education and become a great radio engineer. It may be that some obscure individual may even stumble upon the solution of some of the problems that baffle the laboratory—there is always that chance. Marconi was a mere boy when he discovered wireless telegraphy.

But the discovery of a genius among our fraternity is not what we seek. The world at large can find the man of unusual attainment without the aid of the National Association.

What the National Amateur Wireless Association can do is to lend a helping hand to young men who look for success in a chosen field. Development of promising material is the



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initial purpose and foremost aim of the Association. The direction of co-operative or group working is obviously the best way to do this. I, personally, have great faith in the future of the amateur. Give him a sincere co-worker and outline the compass of experiments, bring him by progressive steps from backyard communication to long distance receiving, and something is going to happen somewhere. Maybe it won't be an epoch-making invention, but it is very likely to be the initial development of an engineer to be heard from some day.

### The Main Purpose of the Association

As editor of THE WIRELESS AGE magazine and its predecessor, I have had four years of close contact with amateurs, some of them boys, many of them men. I am personally acquainted with a score or more men who have passed their forties and are just as enthusiastic as my younger friends. I know amateurs who have spent hundreds of dollars on their stations; I have "listened in" at these equipments and caught messages that were winging their way through space thousands of miles away. I have seen novices rise high in the field of radio communication; I count among my friends (and incidentally look to him for very material support in the association work about to be commenced) a man who began his wireless work as an amateur and to-day is recognized as an authority. And there are others; many of the best operators in commercial service have come from the amateur ranks.

But these things are well known. What we want to get at is the service the National Amateur Wireless Association is to perform. Co-operation has been mentioned; coupled with this is direction of experimental work. How can this best be accomplished?

This country is nearly 3,000 miles wide and half as long; no possible arrangement would permit the governing officers to come in personal contact with each member with any regularity, even if this were desirable. What the Administrative heads purpose doing, and will do, is the establishment of close relations with a vast army of lieutenants, in the persons of those active in the direction of the many community clubs, state and interstate associations. Existing organizations will be promoted, aided to further growth, and where a community lacks a club every effort will be made to create one. Fuly accredited officers of existing organizations will be admitted to the national council and special provision will be made to have them meet in convention at regular intervals. The membership roll of the National Amateur Wireless Association will be wide open; every amateur who is properly endorsed may come in as an individual. According to his abilities and geographical location he will be entered for eligibility in some existing club or association, published recognition of anything noteworthy he accomplishes will be given and, in due course, admittance to some engineering body will be arranged for. Progressive courses of study will be placed in each member's hands; experiments far removed from the usual dry-as-dust textbook recommendations will be added, a monthly bulletin of new call letters and other items of interest will be included. Everything that a body of national officers of wide experience finds essential to the welfare of the amateur will be provided for.

### Part of the Preparedness Movement

To give some idea of how broad will be the activities of the National Amateur Wireless Association and how interesting and useful the work of its members, I can speak of one arrangement that will certainly appeal to every experimenter with live blood in his veins.

Within a very short time it will be possible for small clubs in their entirety, or larger organizations through division into groups, to affiliate with military organizations as accredited members and officers of signal corps. Next summer these signal corps will enter military training camps similar to the one recently so successful at Plattsburg, where the mayor of New York served as a rookie. Those who wish it, and secure the recommendation of the National Association, may become full members of a third line of defense for the safeguarding of the nation in event of war.

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### The Military Value of Wireless

Should this country be invaded—and let us hope it never will be!—the work of the wireless signaling corps would be of the utmost importance. We Americans are just awakening to our perilous position; there is talk of preparedness on all sides and, thanks to the great and wise statesman who is directing the affairs of our nation, we are going to see something done.

Now battleships and standing armies are very necessary; so is the militia; let use hope we are provided for generously with all three. No doubt full provision will also be made for adequate wireless telegraph equipment of our land and naval forces—wireless is one mighty important adjunct to the modern war machine. Before going further into the plans of the association, let me give some hint of just how important wireless has become.

One of the first moves made by all the belligerents in the Great War was the attempted capture and destruction of wireless plants, no matter how small nor where located. A very good reason why this should be done can be given by recalling a single incident in which a tiny station performed notable service.

About this time a year ago one of the most formidable of Germany's naval units disapepared with the destruction of the Cruiser Emden. This vessel had been using wireless with equal effect in eluding her pursuers and in timing her spectacular raids; it was even hinted—and not without reason—that her activities were being directed by wireless from Berlin. She had a remarkable record of depredations and a reputation as a phantom scourge of the seas when, early in the morning of November 9, one year ago, she came to tiny Direction Island, one of the Cocos Group in the Indian Ocean. Her mission was plainly the destruction of the wireless and cable station maintained there by the Eastern Telegraph Company and operated principally as a relay station between Europe and Australia. To those on shore the war had seemed very far away; official bulletins passed through the station daily, but these were seldom exciting and the beach patrol had never sighted anything resembling a hostile warship. When the Emden made her apeparance she flew no flag, and this left little doubt as to her nationality; immediately the spark of the Direction Island station crashed forth its apepal for aid.

At six in the morning the cruiser sailed into the lagoon and landed forty men; three hours later the wireless station and the electrical stores building had been blown up and the Germans were grappling for the cable. Suddenly the Emden's siren shrilled forth the blast for recall, and although the landing party dashed to the boats and pushed off at once, the war vessel got under way so rapidly the small boats were left behind. A faint smudge of smoke on the eastern horizon told the tale. The Australian cruiser Sydney, summoned by the little station's SOS was hot on the trail of the raiding cruiser. Eighty minutes later the battered and hole-riddled Emden was ashore on North Keeling Island, a total wreck.

### How Amateurs Could Aid in War

It was one of the ironies of fate that wireless telegraphy, which had served this vessel so well, should prove her undoing. But what is of more import to us is the fact that this valuable enemy vessel's destruction was brought about by the prompt action of the man at the key on this little island station. With this country at war our many miles of coast line would require the services of hundreds of wireless operators. A reserve corps made up of amateurs would be of inestimable value to the nation.

No less an authority than Gen. Nelson A. Miles said at the outbreak of the war that wireless would revolutionize warfare. And already we have seen that this new art has changed all the old problems of communication. It is no longer possible to bottle up a place so that it cannot hold communication with the outside; along frontiers or between close-lying countries small apparatus can be secretly used under cover of darkness. In support of this contention is the well-known fact that the British War Office is using direction finders to detect spy stations.

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### The Aerial Scout

We have also to consider that within these last few months the aerial scout, hitherto confined to the pages of romance, has become a real factor, occupying a fixed position in the equipment of the great modern fighting machine. Wounded officers back from the front speak of regular systems of flight over predetermined routes above battlefields during the engagements. Communication by wireless with military bases is an important function of these aerial scouting expeditions, and although we cannot yet learn definitely what is being done and the distances covered, it is obvious that the instantaneous communication of details regarding enemy positions is effected over considerable distances. The aeroplane wireless sets of the U. S. Army have demonstrated their effectiveness over distances of fifty miles and it is safe to say that the equipments of the belligerents in the war now raging have ranges as great or greater.

Control of the seas in wartime is universally recognized to-day as of the utmost importance, yet few have considered, I venture to say, how great has been the value of wireless in this connection.

In the War of 1812 this country's vessels were effectively used as commerce destroyers and inflicted great damage upon the British merchantmen in spite of that nation's command of the seas. It was all a matetr of speed; the Americans did not attempt to defeat the mighty war fleets, but they built ships swifter than those of the British and sent them out to destroy the merchantmen and inferior war vessels which they encountered. In the Civil War, too, the Confederates built a few swift cruisers and—while they never had a navy capable of coping with that of the Federals—played havoc among the Union merchantmen.

Through wireless all this has been changed and the cruisers have lost much of their effectiveness. The fate of the Emden is a good illustration of how close tab can now be kept on raiders. The fastest cruiser afloat cannot long escape capture these days. Furthermore, the merchant vessels have been many times warned by wireless of the presence of enemy ships and have thus been able to elude them.

In the present war the cruiser serves principally as a scout vessel attached to a fleet at sea. While thus far there has been no decisive naval engagement upon which can be based definite conclusions, the battle formation as it now exists considers very definitely the utility of wireless telegraphy; safety of the entire fleet may depend upon it. Each war fleet at sea is preceded by a complement of cruisers spread out over many miles; the duty of these ships is to immediately report the presence of hostile fleets and to this end one of the vessels of the main fighting force has its wireless equipment attuned to the wavelength used by each cruiser. Sighting an oncoming enemy fleet, information covering the number of ships, their speed, direction and latitude and longitude is flashed back by wireless and the receiving ship reports to the admiral by semaphore or morse-lamp. Under the same conditions destroyers in large numbers are added for advance scouting.

### Naval Strategy Revolutionized

The wireless equipment of a fleet at sea serves in still another way. Each ship station is attuned to whatever shore stations are within communicating range; to one vessel is assigned the task of receiving messages from naval headquarters. Communications covering general foreign intelligence and the movements of foreign ships—reported from all quarters to this central station on shore, by wireless, cable, telegraph, telephone, or all four in combination—are sent out by wireless to the fleet at sea. The admiral can thus lay out his attacking program in acordance with the conditions to be met. In this latter connection might be mentioned the fact that the great Marconi transatlantic station at Carnarvon, Wales, was taken over by the British Admiralty soon after the commencement of the war and has since been in constant use for the direction of vessels at sea. Incidentally, too, as many of you know, this same station has kept in communication with Russia, right over Germany itself.

Instances of the effective employment

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of wireless in warfare are so numerous I might go on for hours merely telling of them; automobile stations have been used, so have cavalry knapsack equipments and cart stations. The few details which have been given merely serve to outline the widespread usage of this marvelous art of radio communication and indicate how great is the wartime demand for wireless operators.

### Marconi on the Great Test

At the last annual meeting of the company which bears his name, Mr. Marconi recalled his remark of the previous year: "The value of wireless telegraphy may one day be put to a great practical test; then, perhaps, there will be a true appreciation of the greatness of the work." He added that he had full confidence that when the war is over, and the facts can be made public, this appreciation will not be lacking.

On the same occasion he made a statement to the British shareholders which bears directly on one of our problems. He said: "The company has received more than one letter of appreciation from the Lords Commissioners of the Admiralty in respect of the work they and the members of their staff have done. It will interest you to know that from our companies some 1,100 men are employed in the forces in active service or on special duties, apart from the very large number at the head office and works who have been requested to remain at their posts, where by so doing they could render great service to the country.

That is a remarkable statement—1,100 men on active service! Think of this country's problems in time of war! We have a shore line of 21,354 miles to defend; the gross area of the United is more than three and one-half million square miles. How many wireless operators would we need?

But—and here is the distressing situation—where would we get them? I haven't at hand any figures from the Department of Commerce to show how many operators hold commercial licenses. But I have just seen a license issued yesterday, and from its serial number I take it there are but twelve thousand-odd commercial operators. Consider this figure and the necessity for drafting the extra 1,100 civilian operators mentioned, always keeping in mind that each vessel in England's mighty navy is wireless equipped and manned by enlisted men. The British have paid a great deal of attention to wireless telegraphy, yet the enlisted forces of the Allies were 1,100 short! Soon after war was declared the Royal Naval Volunteer Reserves appealed for recruits with knowledge of wireless signaling; it is reported also on good authority that even the boys' organizations were called upon for aid in the government's plans for defense.

It is easily seen why the United States has not more commercial operators. American-owned merchant ships are few, and many of the foreign vessels prefer operators of the same nationality as the owners. We would have difficulty at the present moment in mustering sufficient wireless men of experience to provide for defense of even a small strip of our coast. The solution of this problem quite evidently lies with the amateurs. The official figures give 3,836 licensed amateurs. I can say conservatively that double that number could pass the examination. Under the guidance of the National Amateur Wireless Association, a reserve force of competent wireless operators adequate for all our needs can be developed within a year.

### Special Training Necessary

I feel quite certain that the general public does not understand the difficulties of creating a wireless corps; probably the general impression is that anyone who can handle the Morse alphabet on the telegraph key is qualified for wireless operating. We workers in the wireless field understand, however, that the most skilful key manipulator is practically valueless until he has mastered the technicalities of the equipment. And this is something that cannot be learned in a day, a week or a month.

Members of the National Amateur Wireless Association who desire military training, may have it. Among the distinguished men in our National Advisory Board of Vice-presidents is Major William H. Elliott, a signal officer of wide experience and Adjutant General of the

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Junior American Guard. Major Elliott will serve as military advisor to the Association and take an active interest in all its affairs. He has had wide experience in training young men, as any member of the Boy Scouts can testify, and for the past six months has been engaged in the organization of the Junior American Guard, commanded by Brigadier General Andrew C. Zabriskie and supported by a long string of prominent American military men. This organization takes the form of a popular patriotic movement and is established on a strict military basis, its organization conforming with that of the United States Army. It already has 3,000 members and forty companies drilling. Boys from 12 to 18 years are eligible and the movement is nation-wide.

### Eligibility to Signal Corps

As a vice-president of the National Amateur Wireless Association, Major Elliott will approve all applications from members who desire to affiliate with local companies or battalions as signal corps. Small clubs, properly endorsel, may come in as complete corps; larger amateur organizations, with hundreds of eligible members, may affiliate in smaller groups. Approved members of the National Amateur Wireless Association, who are beyond the age limit, will be admitted as officers and serve as military signaling instructors. Weekly drill, reviews, parades, summer encampments and manœuvres are some of the activities which may be shared in by those with military leanings. Under the arrangement just outlined this important branch of preparedness with a third line of defense can be pursued by our members, old and young. Nothing could be finer for our wireless enthusiasts who have passed into man's estate than to take up the work of instruction in wireless signaling; I feel certain that the response from older amateurs will rival that of the young patriots.

But, even though there is much more which might be said on military aspects, the greater general work of the National Amateur Wireless Association has scarcely been covered. First, let me tell you about the men who will direct its affairs.

Our president is none other than the great inventor, Marconi. In accepting this office, just before his departure for the front, Mr. Marconi stated that the organization had his full approval and he would aid its success in every way possible. That he has never before accepted an executive office in any similar organization speaks eloquently for the worthy purposes of the association. As our chief counsellor we have, therefore, the world's greatest authority on radio communication. Mr. Marconi's signature will appear on every membership certificate and will doubtless remain a prized possession for many years to come.

For administrative officer, or acting president, the selection has fallen upon me. The reason for this is given as wide acquaintance in the amateur field and familiarity with the educational needs of that field. No great personal achievement appears in my record and I fear my only claim to recognition lies in the fact that I have devoted every day (and a great many nights) during the past four years to establishing, directing and editing the leading magazine in the wireless field. Whatever deficiencies I may have as administrative officer I hope to remedy with experience, just as I have tried to as an editor. To be great in the latter vocation it is not necessary to know "everything"; it is only necessary to have a clear conception of what you don't know. I venture the prediction that before the change of the moon my administrative education from National Association members will begin. I shall discharge my duties as best I know how; the brilliant staff of advisors which surround me should make these not only easy, but pleasant.

Clayton E. Clayton, who has been associated with me for some time, will serve as managing secretary and upon him will rest the responsibility for the very considerable amount of detail work.

### Some of the Officers of the Association

Major Elliott has already been mentioned as one of our vice-presidents. On this national council board also is Alfred N. Goldsmith, assistant professor of physics, College of the City of New York, instructor in radio engineering and

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editor of the Proceedings of the Iinstitute of Radio Engineers. Professor Goldsmith is one of the most brilliant men it has been my good fortune to knew. His achievements in the field we purpose to occupy need no mention, novice and scientist alike know and respect him as one of the country's most sincere workers and a student of the phenomena of radio communication who has pursued his vocation with an energy and application which make most of us appear as drones. In this man the National Amateur Wireless Association has an officer who is in a position to directly approve full recognition of any member who may distinguish himself; admission to the Institute of Radio Engineers, in which Professor Goldsmith is a moving spirit, is but one of the ways he can serve the interests of deserving amateurs.

**Experts to Solve Technical Problems**

Then there is Professor A. E. Kennelly, of Harvard—he certainly needs no introduction; his high standing in the educational development of radio experts is known to everyone who can distinguish the difference between a generator and a transformer. The same applies to the remaining vice-presidents, Professor Samuel Sheldon, of the Polytechnic Institute of Brooklyn, Professor Charles R. Cross, of the Massachusetts Institute of Technology, and Hiram Percy Maxim, inventor of the Maxim silencer and president of the American Radio Relay League. With this dazzling array of experts no technical difficulty can arise among members which will not find quick solution.

E. E. Bucher, Instructing Engineer, Marconi Wireless Telegraph Company, will serve the Association in the same capacity and has consented to devote a considerable portion of his time to this particular work.

To assist this advisory board there will be a National Association Council made up from existing clubs, state and interstate organizations, presumably the presidents or secretaries, at the option of the club's ballot from individual members. This council shall be considered the direct representative of the combined amateur club interests and will be called upon to assist the National Association's executives in disposing of such measures as may arise. Committees on membership, organization, publication and equipment are provided for and will be appointed later.

The headquarters of the National Amateur Wireless Association will be located in New York. As a temporary arrangement, space has been set aside at 450 Fourth avenue and through the kindness of the owners of the magazine I direct, these quarters will cost us nothing. I trust we can make this a permanent arrangement, as the organization dues are placed so low no funds can be appropriated for rent. The Association needs principally a mailing address as it is strictly a co-operative body and the acive work it directs will be carried out by club lieutenants all over the country. Club rooms for the National Association would add needless expense and, if it can be continued, the present arrangement is an ideal one. All our work will be carried on through bulletins, the official organ, and through the National Council representatives of the various clubs. Personal contact with the National officers will be made possible through conventions which will be held in central points at stated periods to be determined later. Those who guide the destinies of the National Amateur Wireless Association are all very busy men and, while they will faithfully serve in advisory capacities when requested to do so through the regular channels, individual appeals should not be made direct to them. Every man holding office and serving on the boards of the association does so without one cent of compensation; it is only fair to them that petty questions which can be settled among the amateurs directly concerned shall not be referred higher up.

**The Educational Plans**

As to the educational plans thus far outlined, this much can be said: Each individual who enrolls as a charter member will receive a volume entitled "How to Conduct a Radio Club" which will treat exhaustively of parliamentary procedure, construction of sending and receiving equipment, portable sets, indoor and outdoor experiments, use of barbed wire fences, rain gutters and bridge rails as aerials, long distance receiving by use of

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kite-flown aerials, how to construct a 5,000 mile receiving set—in fact, everything that the most ambitious amateur cares to know about the most interesting phases of a fascinating pursuit. Another volume will contain a complete list of the call letters of all the wireless stations, ship and shore, throughout the world. Any message received may thus be immediately identified and a progressive record made of the distances received by the member's own set. To suplement this list and keep it corrected up to date a monthly bulletin will be sent to each member. As the official government publications are issued only once a year, this service will prove invaluable. Newly licensed amateur stations, as well as commercial stations, will be included in this bulletin. A third standard book is also to be given. This book is entitled "How to Pass U. S. Government Wireless License Examinations" and contains the answers to 118 actual questions asked by the naval examiners, covering completely the knowledge necessary to qualify as a licensed operator. These three books, properly employed, will equip any persevering amateur with knowledge that will enable him to look toward the higher engineering branches of radio communication. In combination with the monthly bulletin service these volumes have, at a low cost estimate, a valuation of at least two dollars. Charter members will also receive an annual subscription to THE WIRELESS AGE, the official organ of the National Amateur Wireless Association. In addition to the familiar regular instructional features of this magazine, space will be reserved for reporting the activities of members.

### The Membership Certificate

The membership certificate is a handsome steel engraving, with half-tone shadow background. A 36-inch aerial pennant, which will also be given to each member, is one of the most striking ever produced; the insignia is worked out in four colors. This design is also repeated in color on the membership pin. The full charter membership equipment can be conservatively valued at five dollars. I mention this merely to show that instead of being a money-making proposition, the charter member dues of the National Amateur Wireless Association do not cover the cost of producing the equipment. The charter members will be required to pay only $2.50 when accepted for admission. In cases where individuals may already own one or more of the standard textbooks or have unexpired subscriptions to the magazine, the amount paid for these will be deducted from the membership fee. Those who are unable to pay at once the full dues will be enabled to come in on the part-payment basis provided for in the official announcements. No deserving amateur is to be deprived of membership through lack of money. The fees have been kept down to the lowest possible sum at which the equipment could be provided. And it is only through the generosity of those associated in official capacities that these excellent arrangements have been made.

### Bright Future Ahead

The National Amateur Wireless Association comes into official existence on November first. From that date on applications for membership will be received if mailed to the present headquarters. Licensed amateurs will be admitted to membership within a few days after application is received. Those not possessing licenses, and under legal age, will be required to furnish two adult references who will vouch for their character. Investigations will be pursued promptly and prompt notice of admission or rejection will be given.

The great future in store for this organization will be recognized at once by all wireless workers. It represents the first movement for development of experimenters in an art which is of ever-increasing importance to the world. Contrasted with other fields of endeavor, members of the National Amateur Wireless Association will occupy an enviable situation. The leading authorities in the country and the world's greatest expert in wireless communication have enthusiastically come to a hitherto unrecognized class of experimenters and offered to direct them in the acquisition of radio knowledge. These men have planned for you; it now remains but to take advantage of the alluring prospects offered.

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# Announcement and Application Blank

# National Amateur Wireless Association

PRESIDENT, Guglielmo Marconi.

NATIONAL ADVISORY BOARD OF VICE PRESIDENTS

Professor Alfred N. Goldsmith
College of the City of New York, Institute of Radio Engineers.

Professor Samuel Sheldon,
Polytechnic Institute of Brooklyn.

Professor A. E. Kennelly,
Harvard University.

Professor Charles R. Cross,
Massachusetts Institute of Technology.

Hiram Percy Maxim,
President, American Radio Relay League.

Major William H. Elliott,
Adjutant General Junior American Guard.

E. E. Bucher, Instructing Engineer, Marconi Wireless Telegraph Company.

ADMINISTRATIVE OFFICERS:

ACTING PRESIDENT,
J. Andrew White,
Editor, THE WIRELESS AGE.

MANAGING SECRETARY,
Clayton E. Clayton,
450 4th Avenue, New York.

A proposed national organization of wireless amateurs was announced in the October number of THE WIRELESS AGE. Further details of the organization are given in an address made by J. Andrew White, which is published in this issue of THE WIRELESS AGE. Read it carefully! It is of vast importance to the wireless amateurs of America.

## ENROLLMENT OF CHARTER MEMBERS.

During the next three months, charter members of the National Amateur Wireless Association will be enrolled on special arrangement. Charter members will receive the following:

## CHARTER MEMBERS' EQUIPMENT.

**1st. CERTIFICATE OF MEMBERSHIP.**

The handsomely steel engraved Certificate, with shadow background half-tone, is sealed and signed by Officers, with the endorsement of Senatore Marconi, as President. Every member will want to frame and place it alongside of his Government License certificate, two documents establishing status as wireless amateurs.

**2nd. AERIAL PENNANT.**

The 36 inch aerial pennant, painted in four colors on scarlet felt, will stand long service at your aerial mast head. Every member will be proud of the National Insignia flying from his aerial.

**3rd. MEMBERSHIP PIN.**

The National Amateur Wireless Association Pin in gold and enamel is the National emblem of the Association. The design shown on this page can but faintly describe its handsome appearance in three colors and gold. The pin has a special patented hub and shank which permits it being securely fastened on the coat lapel or on the vest without turning upside down.

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# War Incidents

## Marconi's Impressions After a Trip to the British and French Lines. An Interview With a Wireless Man Held as Prisoner in England. The Experience of Operator Maisch

"THE armies of French and Joffre are making a veritable hell for the Germans. The onslaught of the Allies' guns has been terrific."

Guglielmo Marconi, lieutenant in the Italian army, who returned to London on September 20 from a five weeks' trip to the British and French lines, thus spoke of the awful havoc of the Allies' advance in the Western theatre of war. Mr. Marconi, for six days, was an eyewitness of the offensive of the Allies and saw the huge force of British and French soldiers rush from the German trenches and observed the slaughter of the Germans that ensued.

In an interview in a newspaper he gave it as his opinion that the events on the western front were but the promise of a more insistent advance by the Allies. He is inspired with unbounded confidence, after what he has seen, of the ability of the Allies to push the Germans out of France; but he feels, because of the advantage the Germans gained in their quick entry into France at the start of the war, that it will be some time before they are entirely dislodged. He predicts that eventually the Allies will drive every German out of France and will keep going across the German border, if occasion demands it.

"I agree with Lord Kitchener," he said, "that the Germans have shot their bolt. Events show beyond doubt that the Allies are now able to take the offensive with every sign pointing to the ultimate victory of their arms. After all these long weeks of living in the trenches while the Germans have gradually driven their way into Russia, the reverse in the Allies' favor in the west is inspiring to every one who is hopeful of Germany being crushed. The spirit of the Allies to beat the enemy was brilliantly reflected in the momentous charge that began the morning of September 25. The advance is still on; and from the way it was going when I left the lines, it is pretty sure to keep up. One might say the Allies have the Germans on the run.

"And it is well to reflect that while the British and French are pushing the Germans out of France, their big ally, Russia, now appears not only to have stopped the German advance in the east, but is regaining lost territory. It all augurs for the ultimate success of the arms of all the Allies."

Mr. Marconi went to the British-French lines to inspect the operation of wireless outfits, and while he was nearing the completion of this work came the dash of the Allies upon the German trenches. He was in the battle zone when the advance started.

"There was a tense feeling in camp the night before the British-French attack," said Mr. Marconi. "Whispered word went around that soon the time was arriving when the Allies, tired of waiting in the trenches, were to spring at the enemy. While the soldiers did not know exactly when the dash would happen, they were on the keen edge of expectancy, convinced that it was only a matter of a few days or even hours.

"Just after daybreak came the order of 'Forward.' The effect on the men was electric. While the soldiers, with faces eager for the fray, jumped from the trenches, the great guns in the rear began belching out a rain of shells. Soon the roar was taken up by smaller guns, until the air was simply filled with smoking, screeching shells driving deadly fire straight into the Ger-


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man trenches. I want to say that the aim of the British and French gunners was magnificent. They hit exactly where they wanted to and with telling effect. The German trenches were literally blown to bits.

"While this inferno was going on the British and French soldiers, under command of cool and courageous officers, were tearing their way through the barbed wire entanglements and making for the trenches from whch the Germans were trying to scramble. The attack so surprised the Germans that for a moment they seemed confounded by it. But after leaping from their trenches their officers checked the panic, and the Germans tried to make a stand for their lives. They turned their heavy guns upon the onrushing Allies, ploughing into the very heart of the attacking force. For just one instant the Allies' lines trembled under the deluge of iron; then, with their artillery roaring behind, they pushed on up to the muzzles of the guns. Brave men were mowed down in the ranks of the Allies in this amazing onslaught, but the loss to the Germans was infinitely worse. The British and French soldiers pushed ahead in face of a blistering, withering fire until they reached the trenches, where they used their bayonets on the enemy. This hand-to-hand attack was too much for the Germans, who were forced to draw back to save themselves from utter destruction.

"When the Allies saw the enemy retiring, they went at the fight with fresh energy. While the German guns poured out a hurricane of shells and the air craft rained down bombs, the Allies with sublime heroism pursued the attack until the Germans were chased clear out of their trenches, and forced to retreat way beyond them.

"In the early period of the war and up to only a short time ago it was apparent the Allies were not fully equipped with munitions. This advance in the Western theatre has proved that, whatever lack there was before, it no longer exists. It may be taken as assured that the Allies have enough shells and heavy guns now to maintain their offensive. One cannot say that the supply is inexhaustible, for nothing is inexhaustible; but they have all they need. If they hadn't, they never could have routed the Germans from the trenches, where the Kaiser's men thought themselves snugly secure to the end of the war. The latest guns of the Allies are more powerful than before, and they have shells enough to keep them going night and day without a let-up. Doom has sounded for the Germans."

Mr. Marconi, with a staff officer of the Italian army, climbed a tree one day of the fighting and witnessed the efforts of the German aircraft to fight off the French and British aeroplanes, which were dropping bombs upon the German lines.

"It was a thrilling spectacle to see that air fight while the German and Allied guns engaged in their terrific duel below," said Mr. Marconi. "The Allies showed themselves to be superior with aircraft. While the Germans managed to drop some bombs on the British and French fighters, the Allies' aircraft chased them away and kept the supremacy of the air while their men afield drove the Germans to retreat."

Mr. Marconi said that his wireless apparatus was now working perfectly in the field.

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Stanley Russell, Marconi wireless operator, who was held as a prisoner of war in England, recently talked interestingly of his experiences. At the time of his arrest he was in the harbor of Shields, being wireless man on the Satsuma. He was formerly operator on the U. S. S. San Marcos, formerly the old battleship Texas, and had made many photographs in various parts of the world, of United States and foreign war vessels, sailors, marines and soldiers at work, and especially of American marines in action in Vera Cruz and in Nicaragua. He also, during his spare moments, had made a neat model of an aeroplane.

While in the harbor of Shields he made a number of photographs. One day when a new British monitor, of the type carrying 16-inch guns, which has been bombarding the Belgian coast,

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passed his ship, he snapped a picture of it.

A short time later British officials clambered aboard and arrested him as a German spy, search of his quarters having revealed his pictures of the armed ships and land forces of various nations and his aeroplane model. Russell appealed to the American consul, but nothing could be done for him, and he had a hard time convincing the authorities that he was not in the pay of the Kaiser.

He finally did convince them, however, but was given an admonitory sentence of fifty-two days in jail. There he was herded with about 100 interned Germans. For the first two weeks of his imprisonment, he said, he was fed nothing but oatmeal, three times a day, with potatoes once a week.

While he was in Shields, a Zeppelin flew over the city and dropped some bombs, which did considerable damage. The people are in deadly fear of the dirigibles, he added, and seem to think they constitute the chief danger of the war.

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From London comes word that C. J. Maisch, of New York, wireless operator on the Norwegian steamship Seattle and a native-born American citizen, who had been held in custody since the Seattle was captured near the Falkland Islands on March 14th last, has been released as the result of representations made in his behalf by the American Embassy. George Vielmetter, a naturalized American, steward on the same vessel, is still held in the naval barracks at Plymouth, but his release is expected soon.

The plight of the pair was made known in July by the American Minister at Montevideo, Uruguay. The Foreign Office informed the American Embassy that the men had embarked on board the Bangor from the Falklands. The next heard of them by the embassy was a report from the American Consul at Plymouth, who said they had been held to give testimony in the prize court in case the Bangor, which has been renamed the Seattle, arrived in Plymouth in charge of a prize crew.

The embassy was next informed by the American Consul at Dakar, Senegal, that two Americans, one whose name was given as Maisch and the other whose passport proved him to be Vielmetter, had appealed to him by waving passports from a porthole as he visited the Belgian steamship Albertville when that vessel stopped at Dakar on August 11. This apparent discrepancy was explained by the fact that the crew was transferred to the Albertville when the Bangor arrived at Freetown, West Africa, from Port Stanley, Falkland Islands, where she had been held in the harbor from March 14 until July 19.

The Bangor, as she was then known, was captured by the British cruiser Bristol, charged with being engaged in unneutral service. The charge against the Bangor was that she had violated her neutrality by carrying coal and provisions destined for the German auxiliary cruiser Kronprinz Wilhelm.

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## THE NAVY DEPARTMENT INSTALLATION

Work on the installation of wireless apparatus at the Navy Department, which will place the station at Arlington and all other naval wireless stations in direct communication with the bureau of operations through which all movements of the fleet are directed, was recently begun. This is one of the most important steps in the organization of the newly created office of naval operations, over which Rear Admiral Benson presides.

Through five receiving sets which will be erected on the roof of the State, War and Navy Building as many operators can receive all of the messages which come into Arlington from the vessels of the fleet and from the numerous radio stations. In like manner five separate short distance sending appliances will permit the Navy Department to communicate without interrupting the work at the Arlington plant.

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By Katherine Drayton Mayrant Simons Jr

At noon she cleared from the Cooper quay, when the stevedores were through.
The wanton wastrel lipped the piles, and the floodtide frothed in blue.

The freight she bore beneath her hatch, like many of her ilk,
Was the long, sea-island cotton strand that the women wear for silk.

Her lean-faced Mate and Skipper swore, finding no word too hard
To curse the rules of meddling fools at the harbor Navy Yard.

"'Tis money sunk in useless junk and a bit of a nuisance as well,"
Thus they spoke of the Marconi set installed on the Southern Belle.

Above swayed the antennæ, and the crippled lad below
Was listening in for noonday calls, his wizened face aglow.

She made the cape in the dun of dawn, where the hog-backed rollers run,
And raised the lights of Diamond Shoals, gone pale against the sun.

The August sea was sultry-still, the sky remained jewel-blue,
But the underswell swung sullenly beneath the sobbing screw.

The glass, at noon, fell suddenly. Her Skipper gnawed his lip
As the gusty wind veered round behind and struck the plunging ship.

He read the brief marconigram, and cursed its terse advice:
"Gale off the Indies—put to port—" and he tore the message twice!

"By the living God, I'm master here! I dock the Southern Belle
On Monday morn in Boston slip, or else in the slips o' hell!"

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And so they put her helm about and ran for the open sea,
While up the coast the equinox roared in a devil's jubilee!

Till eve she drove before the wind, and, as the night-watch came,
She kicked her rotten rudder loose, and rolled—a helpless frame!

Then through the dark screamed the spark in fluttering flakes of fire,
And in the hold the sea crept cold, ever reaching higher.

'Twas then they piped "All hands on deck," and, by the rocking rail,
One after one the dories spun like tops athwart the gale.

One after one the laden boats went down to dare the sea;
But in his cabin crouched the lad, above the sentient key.

What help was there for sixty souls within the dories frail,
Unless they raised his S O S across the crazy gale

When they had rowed a hundred yards, and knew him left behind,
The wolf-faced Mate put back again, against the sea and wind.

Upon the breath of very death their dory blew—a chip!
They cursed the name of God and man, but could not reach the ship.

And so they drifted past the Southern Belle, through the night and mist,
And, by her tossing lanterns' tilt, they marked her starboard list.

But when the dories in the dawn drew near the rescue ship,
The story of a midnight call was passed from lip to lip.

And so there passed the cotton tramp, from which by wireless call,
Except the little crippled lad, were saved her seamen all.

But somewhere o'er the Tideless Sea, where knights and heroes dwell,
I think the angels found a haven safe for the ill-starred Southern Belle.

I think perhaps there stood upon that shore a Sidney or a Galahad,
Who welcomed to the Shining Sands a little cripped lad.

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# A Key-board Operated Receiving Set

By Austin C. Lescarboura

THE present-day trend of wireless telegraphy is towards simplicity of apparatus, the various instruments being constructed with as few complex features as are consistent with the maximum standard of efficiency. The pioneer instruments with their coherers, decoherers, delicate relays, tape registers and batteries appeared formidable indeed to the layman, and but little less so to the operator. Yet the comparatively simple sets of today are infinitely more efficient, not alone in the matter of operation, but also as regards reliability and the distance achieved. However, the equipments in common use have not reached the stage where they can be employed by folk generally, as have the telephone, the telegraph—in the form of the stock quotation ticker—and other inventions.

Now comes a New York inventor with a wireless receiving set in which all the operations are controlled from a simple key-board. No longer is it necessary to fumble with a varied collection of sliders, handles, switch levers or delicate detectors. Instead, the operator—let us say the person unskilled in wireless—can sit before the cabinet and press the different keys that control the several operations.

The automatic receiving set, as it is called by Walter Goodchild, its inventor, represents a number of mechanical movements applied to wireless apparatus, closely following standard practice. The mechanical movements are controlled by electro-magnets, the circuits of which are regulated from a keyboard. The set comprises essentially an inductive tuner, or loose-coupler; loading coils for the primary and secondary circuits; primary and secondary variable condensers; a fixed detector that requires no adjustment; a fixed condenser, telephones and other accessories found in standard receiving sets. The apparatus is contained in a compact cabinet and controlled from a keyboard of ten keys located in front. The relative values of primary and secondary inductance on the loose-coupler spools, the loading coils, the coupling and the primary and secondary condensers are constantly indicated by a number of dials and movable pointers. It is asserted that the set will tune to 12,000 meters and that every tuning operation, from the minimum to the maximum value, can be accomplished in twelve seconds.

The ten keys of the key-board are divided into five groups, each consisting of an "In" and an "Out" key. Both keys perform the same function in the opposite manner; to be more explicit, one of them causes more coupling, more loading coil inductance, more loose-coupler inductance or greater capacity in either the primary or secondary circuit, as the case may be, while the companion key reduces any of these factors.

The first step in operating the set is to make the coupling as tight as possible. This is accomplished by pressing the "In" key of the first group. Then follows the rough adjustment of the primary and secondary circuits by means of the loading coil switches. This is accomplished by first holding down one of the keys of the first group, which acts as a "shift" key and in action is not unlike that of the conventional typewriter, while the second



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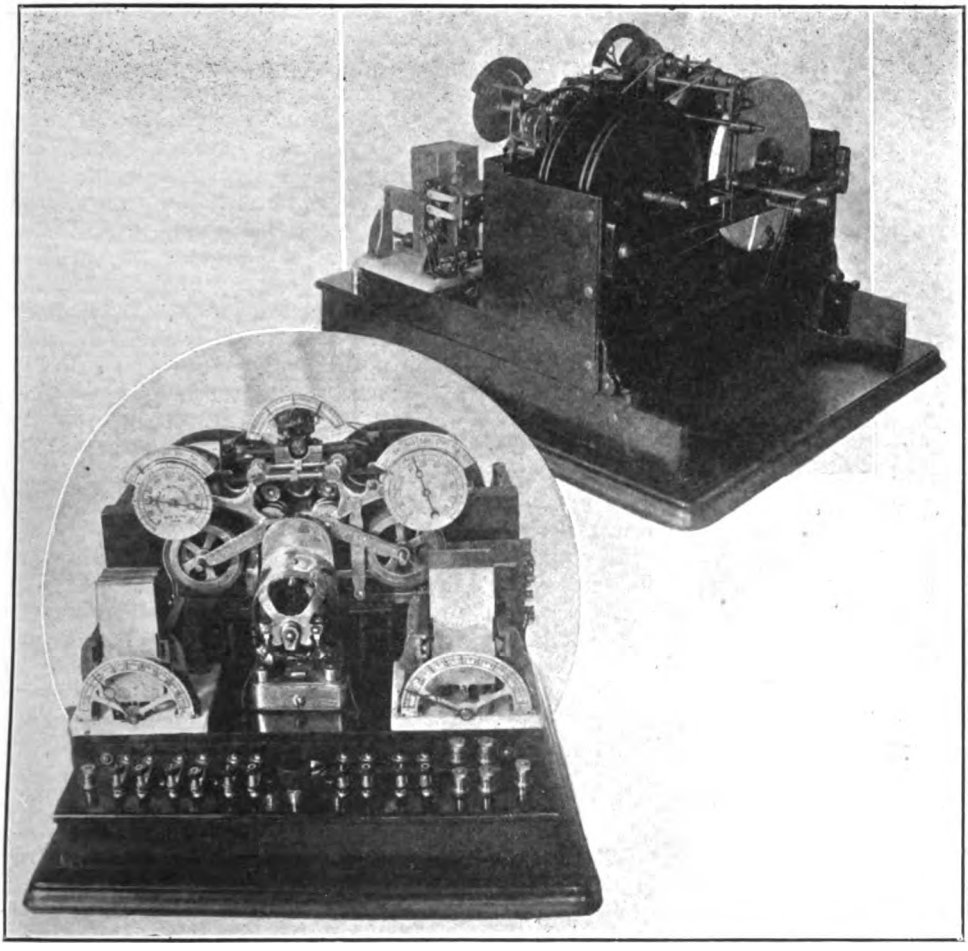

*The automatic receiving set in which all of the operations are controlled from a simple key-board*

and third groups of keys are manipulated. As the "In" key of either group is pressed, the respective loading coil switch lever moves over the switch points, cutting in more inductance. Pressing the "Out" key causes the lever to move in the opposite direction, reducing the inductance.

So far the two circuits have only been roughly tuned, and there remains the finer tuning to be done. This task is performed by pressing the second and third group keys; in this instance, however, the shift key is not pressed; its function is to differentiate between the operation of the switch levers and the primary and secondary fine adjustments, using the same keys. As the "In" key of either group is pressed more inductance is placed in the primary or secondary circuit, while the pressing of the "Out" key causes less inductance to be left in either circuit.

The final tuning is accomplished by means of variable condensers in the primary and secondary circuits. These are controlled by the keys of the fourth and fifth groups. If the operator then desires to use a loose coupling between the two circuits, it is simply a matter of pressing the "Out" button of the first group.

The inductive tuner or loose-coupler of the set is an ingenious piece of apparatus. It consists of four flat spools,


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two of which are fixed and two movable. The latter are mounted on a framework that can be driven forward or backward by means of a spiral drive that is rotated in either direction by pressing the "In" and "Out" keys of the first group. Thus the coupling of the tuner is readily varied. The primary and secondary consists of two spools each, an active spool and an auxiliary or inactive spool, which are mounted on axles so that they can rotate. The winding is in the form of a flat copper ribbon of almost the same width as the groove in the spools. The under side of the ribbon is insulated by a coating of enamel. When the "In" button of the second group is pressed, the two primary spools rotate so that the ribbon unwinds from the auxiliary spool on to the active spool, thus cutting in more inductance in the primary circuit. Pressing the "Out" button causes the spools to rotate in the opposite direction, removing the winding from the active spool on to the inactive or auxiliary spool. The same action takes place with the secondary spools.

The connections with the copper ribbon are effected in a novel manner. The inner end of the winding is connected to the shaft of the spool, while the outer end of the active winding is connected by means of a spiral brass belt that fits into the groove and also serves to guide the ribbon. The brass belt passes over a metal pulley which connects with a binding post.

The driving of the spools in either direction, as well as the altering of the coupling, has been adequately solved. The spools are rotated by a friction drive which can be varied so as to change the direction of rotation. The drive is thrown in by electro-magnets, the circuits of which are closed by pressing the different keys. A friction drive, also operated by electro-magnets, causes the spiral drive to be turned in either direction. A common motor supplies the motive power.

The two loading coils are tapped at intervals and the leads connected to multi-contact switches. The levers of these two switches can be shifted to the right or left, sliding over the contact points, by means of an ingenious ratchet movement. As the "In" key of the primary or secondary inductance group is pressed, the respective switch moves the distance of one ratchet tooth to the right, thus tending to add loading coil inductance. The "Out" key works the switch lever in the opposite direction. The ratchet movement is operated by electro-magnets, each pressing of the key causing the switch lever to travel but a slight distance.

The inventor has found it advisable to use the same sets of keys for modifying the winding of the primary and secondary of the loose-coupler, as well as for operating the primary and secondary loading coil switches. While the keys alone are pressed for modifying the inductive tuner windings, a key of the first group is pressed when the second and third group keys are to be employed for operating the loading coil switches. The arrangement works admirably, and the inventor declares that four extra keys are saved in this manner, not only simplifying the construction but also the operation of the set. In future models a special shift key in the form of a long bar in front of the second and third groups of keys will be provided, accordingly making the operation less confusing.

The two variable condensers consist of a large number of brass plates separated by a suitable insulating material. The capacity is varied by means of two brass rods that pass through holes bored in the plates. These rods short-circuit a greater or lesser number of plates, according to the capacity required. The condensers are each provided with individual motors drawing current from the same battery as the common motor and the electro-magnets.

All of the motive power for operating the set, with the exception of the two variable condensers, is provided by a twelve-volt motor operating from a storage battery. The motor is normally at rest, but starts up whenever the keys are pressed. The latter are of double contact and not only close the electro-magnet circuits, but also that of the motor. Mounted on a special, sound-absorbing base, and provided with noiseless gears running in a sound-proof case, the operation of the motor is practically silent.

The manipulation of the automatic receiving set is marked by simplicity. No

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previous knowledge on the part of the operator is required, a few moments' instruction as to the sequence of the different steps in tuning in a station being sufficient. A rectifying detector that requires no adjustment and cannot burn out or otherwise become inoperative is used, so that the operator need not be troubled with delicate adjustments of any kind. Dials, provided with movable indicators, are located in front of the cabinet so that the relative amount of coupling, loading coil and loose-coupler inductance and primary and secondary capacity may be determined at a glance.

Aside from its employment in wireless stations and especially by the public at large, Mr. Goodchild believes that the greatest use for the automatic receiving set will be in connection with aeroplane work, the simple ten-button control board of the apparatus making it peculiarly suitable for flying machine installations.

It is doubtful, however, whether the new apparatus will have a greater field of application than that found on shipboard. Here, in times of disaster, either to the vessel carrying the set or to some other vessel to which succor is being sent, the automatic receiving set should prove its worth. By means of a multiconductor cable and an auxiliary keyboard the receiving set in the wireless room can be operated from the bridge or any part of the decks. The wireless operator, standing beside the captain or the officers, can keep them constantly informed as to the messages that are being received. When minutes count the set serves its greatest purpose, for every tuning operation, from the minimum to maximum values, can be covered in twelve seconds.

## UNITED WIRELESS LITIGATION ENDS

The filing of a report by Llewellyn Barton with Justice Bird of the Supreme Court in Maine on August 10 was the final step in the proceedings between the Wireless Liquidating Company and the United Wireless Telegraph Company, which have been pending in the State and Federal courts for a period of about three years, and which were brought for the purpose of dissolving the latter company.

Mr. Barton was appointed by the court as special master of auditing the report filed by Judge J. H. Hill as receiver, showing expenditures of $554,247.84. As vouchers there were filed 4,577 canceled checks on the Fidelity Trust Company, varying in amounts from 65 cents to well into the thousands, by which the various claims have been paid off. Included in the disbursements were 4,542 stockholders aggregating 818,478 shares which were allowed, when proven, by James E. Hewey, who was appointed by the Federal and State courts as special master for that part of the proceeding. With the clearing up of the assets of the corporation a dividend of $64.81 was allowed on each share of stock.

During the proceedings since the institution of the case, various claims aggregating $42,450.36 were filed. Objections were made to all of the claims by Judge Hill as receiver with the result that several were disallowed and others were withdrawn. Final settlement of all claims was made for $2,650 and the balance of the funds have been distributed among the shareholders.

## RELIEF BY WIRELESS

A wireless call for a surgeon sent out by a Marconi operator on the steamship John A. Hooper, in the Caribbean Sea, brought medical aid to Miss Annie Christiansen, a passenger, who, during a severe storm fell to the floor of her stateroom, sustaining a fractured leg. Aid was rendered by the surgeon on the steamship Alliancia, which, although thirty-five miles away, responded and the sufferer was given attention.

The doctor, however, recommended that the patient be sent to the nearest hospital which was at Kingston, Jamaica, where Miss Christiansen was taken. She is a sister of one of the owners of the vessel.

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## Chapter XV

### The 2 k.w., 500-Cycle Panel Set

AN outstanding feature of the 2 k.w. 500-cycle transmitting set known as type P-4 is the provision for the use of three standard wave-lengths of 300, 450 and 600 meters, the necessary connections and alterations of circuits for which may be quickly shifted by two multi-point switches operated by a single handle as indicated at H in the accompanying diagram. In addition, the wave-length of the spark gap circuit or closed oscillatory circuit is fiixed at the laboratory and permanent connection made to the primary winding of the oscillation transformer at points A, B and C. The condenser jars of this circuit have a definite value of capacity, .002 microfarad. In the event of puncture a condenser of identical capacity is substituted.

The secondary winding of the oscillation transformer has three variable tap-off connections, A, B and C, for alteration of the inductance value of that winding. When the proper value is located for a given degree of coupling the tap-offs can be permanently held in position by means of a small set screw. The series inductance of the antenna system comprises two spiral coils, S-2 and S-3, connected in series. The inductance of the coil, S-2, is varied by means of three variable tap-offs, while the inductance of the second coil, S-3, is continuously variable.

As stated previously, simultaneous changes of inductance are made in the open and closed oscillatory circuits by means of a hand operated switch. In addition, the variable tap-offs of the secondary winding, S-1, are so located that the degree of coupling for maximum antenna current is automatically selected.

This set is supplied with a quenched spark discharger and a synchronous rotary discharger. The latter is mounted on the shaft of the motor-generator, and is indicated at D. The connections for either gap can be shifted by means of a D. P. D. T. switch as indicated at K. When the quenched spark discharger is employed the primary winding of the oscillation transformer remains in a fixed, mechanical position relative to the secondary winding, the degree of coupling being varied by alteration of the inductance value of the secondary winding alone. When the rotary disc discharger is in use, mechanical means are provided for reduction of the coupling between the primary and secondary windings in order that the set may emit a pure wave in compliance with the United States regulations.

In order that the set may be operated at low values of power an extra resistance coil, 24, is connected in series with the generator field winding. In this manner the total output of the generator can be reduced to a minimum value for short distance work. When this extra resistance is connected in series with the generator winding it is intended to employ only one or two gaps at the quenched spark discharger.

When the switch, H, is shifted to the 300-meter position one half of the available condenser capacity is employed, viz., three jars in parallel having a total value of .006 microfarad. When this switch is set at the 450 or 600-meter position the entire unit of six jars is connected in parallel. The necessary connections to the condenser are made automatically by the primary wave-length changing switch.



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W-1, at the contacts, 40 and 42. The switch, W-1, also introduces a reactance coil, 31, in series with the primary winding of the power traisformer to maintain normal conditions of operation with the reduced value of condenser capacity.

A second distinctive feature of this equipment is the fitting of air circulating blades to the rotary disc discharger, which send a constant pressure of air to the plates of the quenched gap for cooling purposes.

The motor-generator is fitted with an automatic starter of the solenoid type, which can be controlled from a distant point by means of a switch such as is indicated at 17. The circuits of this device also include a dynamic brake having the resistance coil, 8, and the overload relay having the windings, 20 and 22. The motor-generator is fitted with protective devices consisting of paper di-electric condensers for the neutralization of electro-static potentials from the transmitter when in operation. These are not indicated in the drawing.

A third prominent feature of this apparatus is the employment of a direct-current ammeter connected to a thermo couple attached to a heater which, in turn, is connected in series with the antenna system.

### The Complete Circuits

It will be observed from the drawing that the field winding of the motor is connected in shunt with the D. C. line to the regulating rheostat, 23. As the resistance is inserted in series at 23 the speed of the motor is increased and consequently the frequency of the generator. The generator field is likewise connected in shunt to the D. C. line through the low power resistance, 24, and the regulating rheostat, 25. This circuit continues through the contacts of the antenna switch, 62 and 63, through the control switch, 26, and finally to contact 5 of the automatic starter. By this connection the circuit to the generator field winding remains open until the bar, 6, attached to the plunger, A, of the automatic starter, has touched point 5. When the bar of the automatic starter is in contact with point 4, the D. C. armature is connected directly to the main D. C. line.

By insertion of resistance at the rheostat, 25, the voltage of the A. G. generator is reduced and it can be increased correspondingly by reduction of the resistance. .In order that low values of voltage may be secured at the terminals of the alternator, an external fixed resistance, 24, is shunted by the switch as indicated in the drawing.

The overload relay, employed in conjunction with the automatic starter, has the magnet winding, 20, which may be called the tripping magnet and the second magnet winding, 22, which may be called the holding magnet. Winding No. 20 is in series with the D. C. armature on the negative side of the line. If more than a predetermined number of amperes flow through this winding, the lever, 14, is raised in a vertical position, breaking the circuit of the solenoid winding, 11, through the contacts, 13 and 14. Immediately afterward, the circuit through winding 22 is closed through contacts 14 and 21. This causes the lever, 14, to be held in that position until either the main D. C. line switch or the starting switch, 17, is opened.

One terminal of the solenoid winding, 11, is connected to the positive side of the D. C. line at point 12. The circuit continues through the fixed resistance, 9, shunted by the switch, 10, through the contacts, 13 and 14, of the overload relay, through contacts 15 and 16 of the antenna switch to a terminal of the winding, 20, which is of negative polarity. Hence it is readily observed that the solenoid winding is connected in shunt to the D. C. line when either contacts 15 or 16 or the starting switch, 17, is closed.

The switch, 10, in shunt to the resistance, 9, is automatically opened by the plunger, A, of the automatic starter when it is in the full vertical position.

The resistance coil for the motor starter connected in series with the D.C. line to the armature are progressively cut out of the circuit at contacts 1, 2, 3 and 4 by the bar, 6. When the circuit to the solenoid, 11, is closed, the plunger, A, with the bar, 6, moves in a vertical position, the speed of acceleration being regulated by a vacuum chamber. When contact is made between the bar, 6, and point 1, the circuit to the armature includes the entire set of resistance coils.

When the circuit to the winding, 11,

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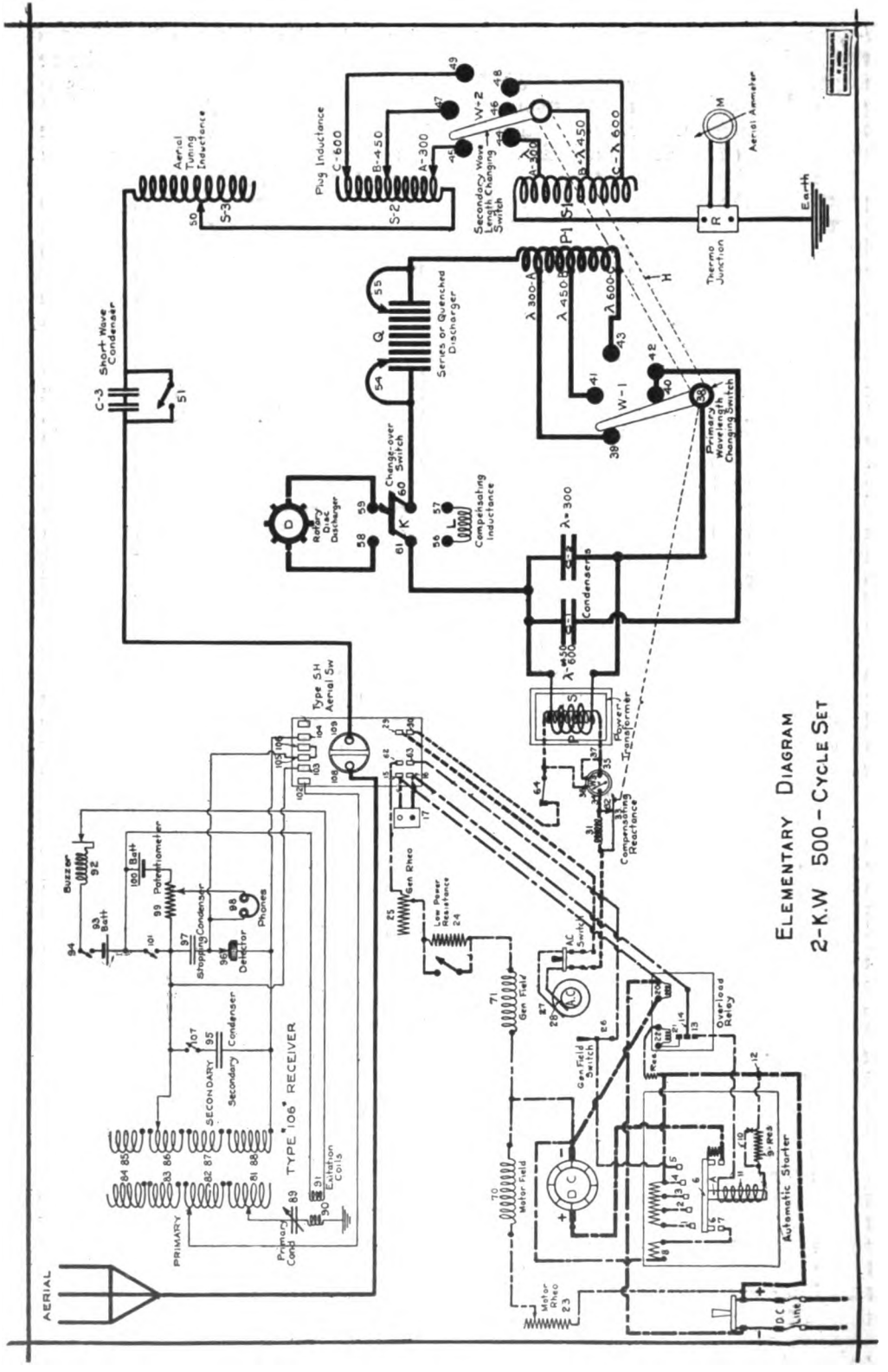


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is interrupted either at point 17 or at the aerial switch contact, 15 and 16, the plunger, A, drops downward and, through the medium of contacts 6 and 7, the resistance coil, 8, is connected in shunt with the D. C. armature. At this stage of operation the momentum of the armature causes it to become temporarily a D. C. generator and when the resistance coil is connected in shunt current of considerable value flows. The magnetic field thus set up in the armature causes a powerful dragging action on the field poles, bringing the armature to a quick stop. To be more explicit, when the handle of the type S. H. aerial change-over switch is thrown to a transmitting position, the motor-generator is automatically started provided the main D. C. line switch is closed. It will be brought to a quick stop when the antenna switch is placed in the receiving position provided the switch, 17, remains open. If the switch, 17, is closed, the motor-generator can be held in a continuous state of operation during the receiving period.

When it becomes necessary to make repairs or adjustments to the motor-generator or the A. C. power circuit, the generator field switch, 26, should be open. When the motor-generator is to remain idle for an indefinite period, the main D. C. line switch should be open to break the circuit to the field winding of the motor.

The high potential transformer has the primary winding, P, and a secondary winding, S. The alternating current from the brushes, 27 and 28, is fed to the primary winding of the potential transformer through the antenna switch contacts, 29 and 30, the transmitting key, 64, the compensating reactance, 31, and the primary wattmeter, W-3.

The wattmeter has four terminals; 34 and 35 are connected in series with the A. C. line to the transformer and 36 and 37 are placed in shunt to the primary winding.

The compensating reactance, 31, is shunted by the switch at contacts 32 and 33. When the primary wave-length changing switch, W-1, is placed in the 300-meter position, the contacts, 32 and 33, are forcibly opened, thereby connecting the reactance coil in series with the primary winding of the transformer.

The circuits of radio frequency comprise the high potential condenser, C-1 and C-2, each containing three jars of .002 microfarad. When operating on the 300-meter wave, the condenser unit, C-2, is connected to the secondary windings of the potential transformer. The closed oscillatory or spark gap circuit can be further traced through the wave-length changing switch, W-1, through contacts 38 and 39 to a small portion of the primary winding of the oscillation transformer, P-1, as is indicated at A. The circuit continues to a terminal of the quenched spark gap, 55.

When the blades, 60 and 61, of the switch, K, are thrown to the contacts, 58 and 59, the synchronous rotary disc discharger, D, is connected in series with the condensers and the primary winding of the oscillation transformer. When this discharger is in use the quenched spark discharger is short-circuited by the leads, 54 and 55. When the switch blades, 60 and 61, are thrown in the opposite direction, that is to say, connected to contacts 56 and 57, the compensating inductance, L, is connected in series with the condenser circuit to make up for the length of leads from the points, 58 and 59, to the rotary disc. In this manner the wave-length of the closed oscillatory circuit remains constant, regardless of the type of spark discharger employed. When it is desired to radiate energy at a wave-length of 450 or 600 meters, the switch handle, W-1, is then moved to the 450-meter or 600-meter position, whereupon the condenser units, C-1 and C-2, are connected in parallel between the contacts, 38 and 40, also between 40 and 42. The closed oscillatory circuit then continues to contact 41 through the fixed tap-off, B, for the 450-meter wave and through contact 43 to the tap-off, C, for the 600-meter wave.

A somewhat similar function is performed by the switch, W-2, in connec-

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tion with the secondary winding, S-1, and the aerial tuning inductance, S-2, that is to say, corresponding values of inductance are selected at S-1 and S-2 so that the proper degree of coupling for maximum antenna current is secure for each change of wave-length. Thus the circuits for the 300-meter position are closed through contacts 44 and 45, for the 450-meter position between contacts 46 and 47 and for the 600-meter position between 48 and 49. Closer variation of the antenna inductance can be made by the continuously variable aerial tuning inductance, S-3, having the sliding contact, 50.

The antenna system also includes the short wave condenser, C-3, which may consist of two, three or four standard Leyden jars connected in series in accordance with the dimensions of the antenna. This condenser is shunted by means of a flexible lead, 51.

### Tuning

When the quenched spark gap discharger is employed the primary winding of the oscillation transformer, P-1, remains at a fixed mechanical position relative to the secondary winding, S-1. Inasmuch as different degrees of coupling are required for different values of inductance in the primary winding in order that the maximum value of antenna current may be obtained, it is the work of the installer or inspector to select such values of inductance by means of the variable tap-off connections at points 44, 46 and 48, and at 45, 47 and 49, in order that the necessary coupling between P-1 and S-1 may be obtained without shifting the mechanical position of these windings.

Complete resonance is maintained in the antenna system by means of the plug connection to the inductance, S-2. The aerial tuning inductance, S-3, is only intended to make up for variation of wave-length in the antenna system, as it may be altered by local conditions such as proximity to a dock or other metallic structures during the tuning period.

To make clear the process of tuning, assume, for example, that at a wave-length of 600 meters, eight turns are employed in the secondary winding, S-2, by the variable tap-off connected at switch point 48; likewise six turns at the tap-off connection to switch point 49. And suppose, further, that when this particular value of turns is in use the coupling between the primary and secondary winding is found to be too large for the maximum current value in the antenna circuit. Then the number of turns of the winding, S-1, connected to point 48 is reduced and a corresponding increase made at the tap-off connected to 49 so that conditions of resonance are maintained in the antenna system. Since the self-inductance of the secondary winding, S-1, is thus reduced, the degree of coupling between P-1 and S-1 is decreased even though the windings, P-1 and S-1, remain in a fixed, mechanical position. Similar selections of turns are made at the two remaining wave-lengths, such values of inductance being taken at S-1 or S-2 by the variable tap-offs which will give the proper degree of coupling for maximum current in the antenna system. The positions of the tap-offs in the secondary winding, as indicated in the drawing, are not necessarily the relative positions for the various wave-lengths. The actual position, of course, must be determined by the inspector.

It will aid the inspector in determining when the proper value of inductance has been selected at S-1 if, during the process of tuning, the coupling between P-1 and S-1 is mechanically altered. Suppose, for example, that if P-1 is withdrawn from S-1 at a given standard wave-length an increase of antenna current takes place. Then the value of inductance at S-1 for that wave-length must be decreased and the mechanical relation between P-1 and S-1 brought back to the normal condition.

It is preferable that the antenna system be tuned so that at all standard wave-lengths the continuously variable aerial tuning inductance, S-3, has from three to five turns included in the circuit. This will allow the correct number of turns for variation of inductance in the antenna circuit below and

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above normal to make up for the alteration in wave-length by the presence of metallic structures at the docks. The proper use of the aerial tuning inductance, S-3, will assist the inspector in determining the necessary values at points A, B or C or S-2 for a given standard wave-length. If, for example, eight or nine turns are required at S-3 for obtaining resonance, the number of turns may be reduced at that point and an increase made at S-2.

It now will be understood that when it becomes necessary to change from one standard wave-length to another it is only necessary to throw the wave-length changing switch, W-1, from one position to the other with the exception that on the 300-meter position the short wave condenser, C-3, must be thrown in series by means of the flexible contact at 51.

When the synchronous rotary spark discharger is employed the distance between the windings, P-1 and S-1, must be increased by a considerable amount in order that the set may emit a pure wave in compliance with the United States regulations.

The relative positions of the primary and secondary windings for the rotary spark discharger are indicated on the coupling scale affixed to the coupling handle. It is sometimes possible to find a fixed position for the 450 and 600-meter waves with the rotary gap, but it is generally observed that the coupling value must be changed for the 300-meter position.

It should be understood that the synchronous rotary gap is only to be used as an auxiliary in case of accident to the quenched spark gap discharger. Care should be taken to adjust this gap so as to avoid an abnormal brush discharger at the condenser, and also to maintain a pure note. The character of the note can be obtained by listening in the head telephones of the receiving set. Particular care should be taken to keep the gap between the stationary and movable electrodes at a minimum, not over .003 to .005 of an inch. If the receiving set is shunted by the type S. H. antenna change-over switch, these circuits should be kept open during the test.

## The Type 106 Receiving Tuner

The fundamental circuits of type 106 receiving tuner are also indicated in the drawing. This tuner is constructed so that the degree of coupling between the primary and secondary windings can be altered as desired by means of a specially constructed rack and pinion Referring to the drawing, the complete primary circuits are represented by the units 81, 82, 83 and 84. Unit 81 is connected to the terminals of a ten-point multiple switch and comprises ten turns of wire. Units 82, 83 and 84 are progressively added in the circuit, ten turns at a time, by means of a second multiple point switch known as the "tens" switch. Unit 84 is an aerial tuning inductance which is mounted separate from the primary windings, 81, 82 and 83.

The antenna system also includes the variable condenser, 89, which is automatically short-circuited when in the "out" position.

The coupling coil, 90, is connected in series with the earth lead and in inductive relation to the excitation coil, 91. The coil, 91, is connected in series with the buzzer, 92, and energized by the battery, 93. The circuit is closed by the switch, 94. When the buzzer is put into operation, impulses of current flow through the coil, 91, which set up a potential in the coil, 90, causing the open oscillatory circuit to be set into excitation at its natural time period of vibration.

The secondary winding of the receiving tuner comprises the coils, 85, 86, 87 and 88, the inductance value of which can be altered by the multiple point switch as indicated.

It will now be observed that the primary and secondary windings are divided into units, thereby eliminating to a considerable extent the effect of dead-ends. To this end a revolving switch of the barrel type operates in conjunction with the inductance changing switches of either winding, connecting the several units in the circuit when required.

The secondary system comprises the shunt variable condenser, 95, the cyrstalline detector, 96, the stopping condenser, 97, the head telephones, 98, the po-

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tentiometer, 99, and the battery, 100. The circuit from the battery to the potentiometer is interrupted by the switch, 101.

The 106 receiving tuner is generally fitted with two crystalline detectors, one of cerusite for long distance receiving work and the second of carborundum for receiving signals at lesser distances. When the cerusite detector is employed, the switch 101, connected in series with the battery, 100, is opened and the potentiometer sliding contact set at the zero position. When the signals are moderately strong, no attention need be paid to the position of the potentiometer switch.

When the type S. H. aerial changeover switch is in the transmitting position, the connection to the aerial post of the receiver is broken at contact 102 and the head telephones are short-circuited by the contacts, 103 and 104. Contacts 105 and 106 are connected together by a small jumper on the switch. When contacts 103 and 104 are shunted, the detector, fixed stopping condenser and the secondary inductance of the receiving tuner are short-circuited. The shunt variable condenser, 95, can be turned to the "off" position where it is entirely disconnected from the secondary inductance.

## General Operating Instructions for the 106 Tuner

Having connected the receiver in accordance with the diagram of connections shown in the drawing, the method of operation is as follows:

Set the condenser at the "out" position, set the coupling knob at about 7 on the scale; set the secondary condenser at "out" and place the detector point on the cerusite crystal. The battery switch should be in the "off" position, the potentiometer at zero.

Then push the test switch in, turning it slightly to the right, which will keep the buzzer in a continual state of operation as long as desired. The crystal point is then adjusted until the maximum response is secured in the head telephones.

Next release the test switch and vary the inductance of the primary and secondary windings until the desired signal is heard with maximum response. Next decrease the coupling by rotating the coupling handle to the left until the signal is just audible. Readjust the primary and secondary windings so as to obtain the maximum response; then increase the coupling until the signal obtained is at a maximum. At this point a slight readjustment of the primary winding may cause increased strength of signals. Generally a louder signal is obtained with a maximum value of secondary inductance and a minimum value of secondary capacity. To avoid interference the operator should work with the smallest degree of coupling possible.

At the lesser degrees of coupling the greatest selectivity can be obtained by using a smaller value of secondary inductance and a larger value of the secondary capacity until a maximum response is obtained. Care should be taken that the used turns of the primary winding for conditions of tight coupling are directly above and in inductive relation to the used turns of the secondary winding. A little consideration of the circuits will indicate that there are two positions, one at either side of the primary winding, where a given degree of coupling may be obtained. The type 106 receiving tuner has a range of wavelengths up to 3500 meters. If the wavelength of the signal desired is shorter than can be obtained with the adjustments given, place the primary "tens" switch at zero, the primary "unit" switch at 10 and rotate the primary condenser until the signal is heard, using the lower point of the secondary inductance. If the maximum signal is not obtained up to 180 degrees of the primary condenser, more primary inductance is required. Follow the same method with the longer wave-lengths. Selectivity in the antenna system can be increased further by using a large amount of inductance with certain values of the antenna condenser connected in the circuit.

With this tuner the telephone receivers have adjustable diaphragms, tuned to 1,000 cycles per second. The operator should adjust these diaphragms to the spark frequency of the incoming signal as in this manner greater selectivity is obtained.

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# Radio Frequency Changers*

By Alfred N. Goldsmith, Ph.D.

## Part I

FOR a considerable number of years after its inception, the development of radio transmission was bound up practically completely with the generation of radio frequency currents by means of the discharge of a condenser in an oscillatory circuit which contained a spark gap discharger. The use of a section of an ionised gas in an oscillatory circuit has never completely satisfied those members of the radio engineering fraternity who are most imbued with the older and more usual methods of generating various types of alternating currents. To them the employment of a spark (which is a never failing source of thermal energy dissipation) has seemed an uncertain method, and they have always believed that the deterioration, uncertainty, and impairment of efficiency of such apparatus did not compensate for its simplicity and comparative inexpensiveness. We shall not here attempt to decide the relative merits of the spark methods of generating radio frequency currents and the newer alternator-frequency changer methods. Such an attempt would be necessarily futile, since only time, patient development of the frequency changers, and detailed experiments under widely varied conditions could definitely settle the question. We shall merely confine ourselves to a description of the various types of apparatus whereby the frequency of an alternating current may be directly increased without the use of the usual gap discharger.

Furthermore, we are completely unconcerned here with the difficult and delicate questions of historical precedence of invention. Unfortunately there can be but little doubt that the courts will be required to adjudicate the property rights of the various inventors in this as in so many other cases. It is only to be hoped that the deterrent influence of such patent litigation on the genuine scientific and commercial development of the frequency changers will be slighter than is usual. We shall attach the names of certain investigators to definite pieces of apparatus as an indication that the investigators in question have clearly described and claimed such apparatus in open publications.

The first method we shall consider is dependent on electro-static induction and involves the use of moving parts. It was first described by Petersen.†

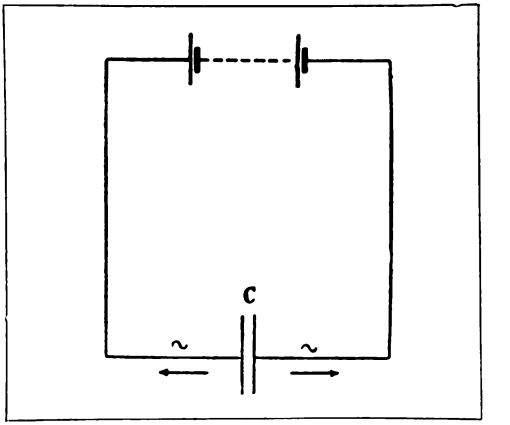


*Fig. 1*

The principle of the machine is illustrated in Fig. 1. As will be seen, the terminals of a battery are connected to the plates of the condenser C.

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† Petersen, German Patent Number 2578.



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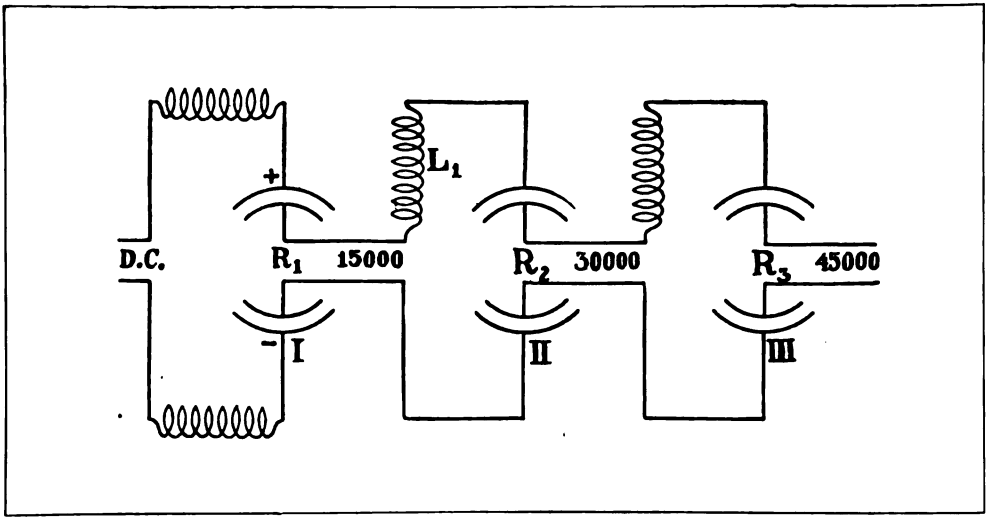


*Fig. 2*

The capacity of the condenser C may be cyclically varied; either by altering the separation of its plates or by altering the dielectric constant of the medium between them. If either of these expedients is adopted, current will flow into the condenser and out of it cyclically, and by appropriate means, alternating current energy can be obtained from the arrangement. It involves a simple type of transformation of mechanical energy into alternating electric energy.

The type of machine just described produces the fundamental frequency which is increased by the method shown in Fig. 2. At A we have a high voltage source, e. g., a storage battery of many cells. Its terminals are connected through large inductances to the field plates of generator I. Within the strong electric field thus produced two sets of insulated plates rotate. Alternating differences of potential appear at the terminals of the rotating armature plates. By properly constructing the machine with due regard to the necessary limits of tensile strength of the materials used, it may be possible to secure a fundamental frequency of 15,000 cycles per second. The terminals of the armature of generator I are connected through the carefully adjusted inductance $L_1$ with the field plates of the second machine, which is a frequency changer. The inductance $L_1$ is so chosen that the circuit in which it is placed is resonant to the frequency $n_1$ of generator 1; which may be, say 15,000. In the electric field of machine II (the first frequency changer) there rotate the arma-

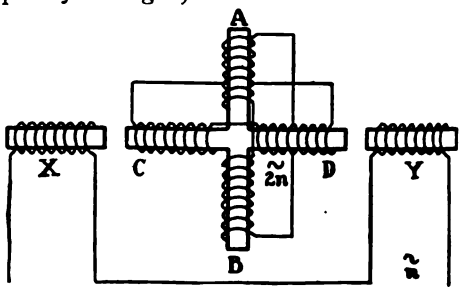


*Fig. 3*

ture plates, and their speed of rotation is chosen so that they revolve synchronously with the electric field in which they move. There will then appear at their terminals an alternating potential of frequency $2\,n_1$. The reason for this is the following. Let $F_m$ be the maximum field intensity in a vertical direction between the field plates. At any time t the field intensity will be

$$F = F_m \sin \omega t$$

where

$$\omega = 2\,\pi\,n_1.$$

Suppose that the armature plates have rotated through an angle $\theta$ from the position shown in the diagram. Then, if **m** is a constant, the instantaneous dif-

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ference of potential **e** between the armature plates is

$$e = m F_m \sin \omega t \cos w t$$

where $w t = \theta$

If, now, we rotate the armature synchronously, so that

$$w = \omega$$

we have

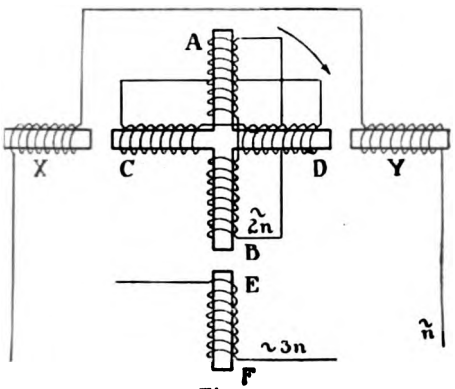


*Fig. 4*

$$e = -\frac{m}{2} F_m \sin 2 \omega t$$

It is thus clear that we are producing an electromotive force of double frequency. Physically this corresponds to the fact that the alternating electric field which is due to the field plates may be regarded as the sum of two rotating electric fields, revolving synchronously in opposite directions. If now the armature also rotated synchronously, it will be stationary relative to one of the rotating component fields and will rotate with twice synchronous speed relative to the other component rotating field. The first of these rotating fields will therefore produce in the armature no alternating potential differences, whereas the second will produce an alternating potential difference of twice the fundamental frequency. This principle should be remembered, since it is also extensively applied in radio frequency changers dependent on electromagnetic induction. As an example of an important machine wherein this method of frequency doubling is employed, the Goldschmidt alternator may be mentioned.

It is therefore evident that in the first frequency changer, an alternating potential difference having a frequency of 30,000 cycles per second will be produced. The process of frequency doubling may be increased through any desired number of steps; though in general with a consequent diminution in over-all efficiency of the system. It is also noteworthy that, by somewhat the same artifice as will be later described in connection with the Goldschmidt alternator, all the frequency transforming processes just described may be caused to take place in a single machine.

As has been stated, each of the circuits consisting of a pair of armature plates, a tuning inductance, and a pair of field plates of the next frequency changer, must be tuned to resonance to the appropriate frequency. The resonance condition, which is readily fulfilled, is that

$$\omega^2 L C = 1$$

where $\omega$ is the angular velocity ($2 \pi$ times the frequency), and L and C are the total inductance and capacity of the circuit in question. The final circuit comprises the armature of the last frequency changer, a tuning inductance, and the capacity comprised by antenna and ground.

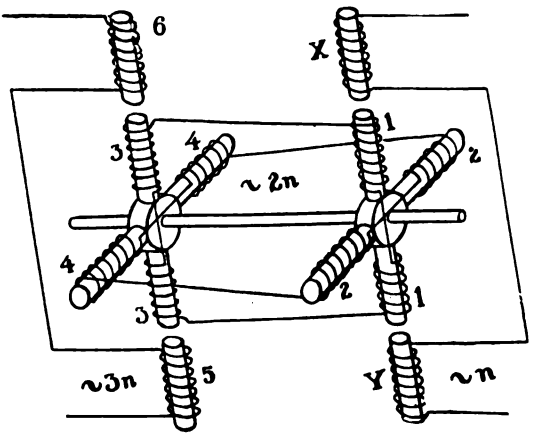


*Fig. 5*

It is as yet too early to decide even vaguely the probable commercial value of this type of machinery. It must be admitted that the electrostatic machine herein described can be built so as to have the utmost simplicity. To avoid losses through high voltage brush discharges, the entire machinery might be enclosed in compressed air as has in fact already been done for the normal

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types of electrostatic generators. A marked increase in efficiency was thereby produced.

Still considering rotary machinery we pass to those frequency changers based on electromagnetic induction. One of the simplest of these is that one worked out independently by E. Arnold and D. Korda in 1893. The circuit diagram is shown in Fig. 3. In this diagram X and Y are two field coils through which a single phase alternating current passes. As a matter of practical construction a great number of arrangements of such a field can be employed; for example, a Gramme ring connected to the alternator at two opposite points of its circumference. There will be produced then, between the coils X and Y a stationary alternating field. The two coils A B and C D, which are mutually perpendicular, rotate in this field. In the figure each of these coils is shown as short-circuited, but instead their terminals may be connected to a slip ring. If now the two coils mentioned rotate at synchronous speed, it can be shown that there will be induced in each of them, electromotive forces of double frequency. The proof of this is quite similar to that already given for the case of the electrostatic generator. Two alternating currents differing in phase by 90 degrees can be obtained from the two rotating coils, and the magnitude of these currents can be brought to a maximum by appropriate tuning through inserted condensers in the circuits connected to the rotating coils. It can be shown further that the sum of the torques for an entire revolution is zero if the coils are rotating in phase with the field of the field magnets.

If we desire to draw energy from this device, that is, to use it as a generator, the rotating coils must lead the field of the coils X and Y. The process of frequency doubling herein described may be carried through any number of stages.

The arrangement described may be modified, as Korda has shown, by using stationary armature coils and rotating field coils. A number of ingenious modifications of this method are possible whereby direct current field excitation can be employed and also two phase alternating current excitation. In this latter case, it is possible to produce currents of double frequency but of cyclically varying amplitude; and such a method may well be applicable for tone production in radio frequency generators.

Korda has worked out a very ingenious method whereby the frequency of an alternating current may be directly tripled. In Fig. 4 is shown the arrangement previously described with an additional coil E F. The field of the two coils A B and C D compound to a single field having an angular velocity of rotation which is twice that of the coils; that is, twice synchronous speed. If now this field were to rotate in the same direction as the coils rotate, its absolute angular

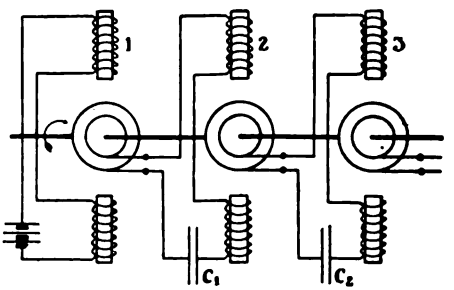


*Fig. 6*

velocity in space would be three times synchronous speed, and if this could be accomplished, there would be induced by it, in the stationary coil E F, a current of three times the fundamental frequency. Unfortunately, in the arrangement shown, the field of the rotating coil rotates in the opposite direction to the coils, and therefore induces in the stationary coil E F a current of the fundamental frequency.

In order to cause this rotating field to have the same direction of rotation as the coils themselves it is necessary to displace the alternating current in one of these coils by 180 degrees in phase. This can be done readily enough in the arrangement shown in Fig. 5. Coils 2 and 4, which are mounted parallel to each other on the same shaft, are wound in the same direction and connected as shown. Coils 1 and 3 are mounted parallel to each other on the same shaft, wound in opposite directions, and then connected. Coils 1 and 2 correspond respectively to coils A B and C D of Fig. 4. It will be

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seen that inasmuch as the current in coil 3 has been displaced 180 degrees through the use of the reversing connection, the field of coils 3 and 4 combined will rotate at twice synchronous speed relative to these coils and in the same direction as that of their rotation. There will therefore be induced in coils 5 and 6 a current of triple frequency. The device described is directly applicable to multipolar machines and it is easily seen that a rapid multiplication of frequency can be produced by its use. It is further advantageous in that no brushes or slip rings are employed.

A further method based on electromagnetic induction and employing moving parts was described by Cohen in the Electrical World in 1908. It was proposed to place a number of alternating current generators on the same shaft, as shown in Fig. 6. The field of the first generator was excited by direct current. The armature of each generator was connected through an appropriate tuning condenser to the field magnets of the next. The device shown is perfectly analogous to Petersen's method previously described. As in that former case, there will be a doubling of frequency in each step. The alternators used in any process of this sort must be particularly adapted to their purpose. A minimum of iron should be used, particularly when working at the higher frequencies. Such iron as is used should have a small hysteresis constant and should be very finely laminated. It may further be stated that the armature reaction in each of the frequency changers will require correction of the values of the tuning condenser of the field magnet circuit of that frequency changer, this correction being different for each different output. The varying permeability of the iron coils employed will introduce a certain error in the tuning, and somewhat diminish the over-all efficiency.

It remained for Dr. R. Goldschmidt to work out the method described in German patent No. 208,206, wherein all the changes of frequency performed by separate machines in the previous method take place in a single machine. The method is diagrammatically illustrated in Fig. 7. Herein the battery B supplied the current necessary to excite the field magnet S on the stator. L is a large inductance intended to prevent the flow of alternating currents through the battery circuit. In the field of the stator S is a rotor which is short circuited for the fundamental frequency by means of the capacities $C_3$ and $C_4$ and the inductance $L_2$. It is to be noted that R and $C_3$ alone would be in resonance to the fundamental frequency, as also would $L_2$ and $C_4$. The complete circuit $RC_3L_2C_4$ therefore contains approximately twice the inductance and half the capacity of either $RC_3$ or

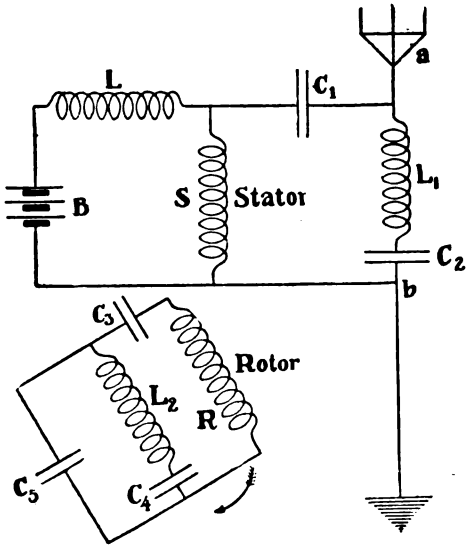


*Fig. 7*

$L_2C_4$. Its period is therefore the same as that of either of these, and even if $L_2C_4$ were to be short-circuited, the rotor would still be resonant to the fundamental frequency. A perfectly similar arrangement is adopted for the stator by the use of the circuit $SC_1L_1C_2$, except that the circuit in question is tuned to twice the fundamental frequency. It will be seen that as the rotor revolves in the field of the stator, powerful currents of the fundamental frequency will flow through it. The great magnitude of these currents is due to the fact that the rotor is itself part of a circuit resonant to the fundamental frequency. If we consider the field of the rotor, we may regard it as resolved into two component fields of constant and equal magnitude, rotating in opposite directions relative to the rotor. Their absolute angular velocity relative

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to the stator will therefore be zero and twice synchronous speed respectively. There will therefore be induced in the stator electromotive forces of twice the fundamental frequency (and zero frequency); and since a circuit resonant to the double frequency is provided, powerful currents will flow through the stator. These alternating currents of double frequency will induce in the rotor electromotive forces of frequencies 3n and n, where n is the fundamental frequency. By means of the condenser $C_5$, a path resonant to the frequency 3n is provided in the rotor. By properly choosing the constants of the various rotor circuits, the current of frequency n mentioned first can be made very nearly to neutralize the second current of frequency n which we have mentioned. The reason for this is that these currents may be brought to nearly complete opposition in phase, and equal amplitude. There will be left then in the rotor a powerful current of triple frequency. Its field may be resolved into two equal and constant revolving fields, rotating in opposite directions, with absolute angular velocities twice and four times the fundamental angular velocity. There will therefore be induced in the stator, currents of frequency 2n and 4n. Of these the current of frequency 2n will nearly completely neutralize the former current of frequency 2n in the stator, which was mentioned above. The outstanding current of frequency 4n, in the diagram of Fig. 7, is shown as flowing into the capacity and inductance formed by the antenna a and the ground b.

In practice, very finely laminated iron of high quality, worked far below the saturation value of flux density, is used in these machines. The air gap between rotor and stator is kept as small as possible, and in some cases special methods of cooling the machine are employed. In order to prevent the radiation by the antenna of some of the lower frequencies, it is desirable to keep the coupling between the various oscillatory circuits at moderate values. Too large a coupling also tends to distribute the energy absorption in the circuits of lower frequency instead of concentrating it in the circuit of highest frequency.

In 1913, Leon Bouthillon described an ingenious type of generator, intermediate in type between a rotary converter and an alternator. It depends on the following principle. If, in any circuit, there are a number of alternating electromotive forces of any wave form, and each of these is equally displaced in phase relative to the preceding, under certain conditions the resultant electromotive force has a much greater frequency than any of the component forces and a very appreciable amplitude. Analytically and more exactly expressed: if there are m such electromotive forces, each of frequency n, and the phase displacement of each relative to the preceding is $\frac{2\pi G}{m}$, where G is a whole number, the resulting electromotive force has a frequency $\frac{m}{V}n$, where V is the greatest common divisor of G and m. The amplitude of the resulting potential difference is the product of m and the amplitude of the $\frac{m}{V}$-th term of the Fourier's series ex-

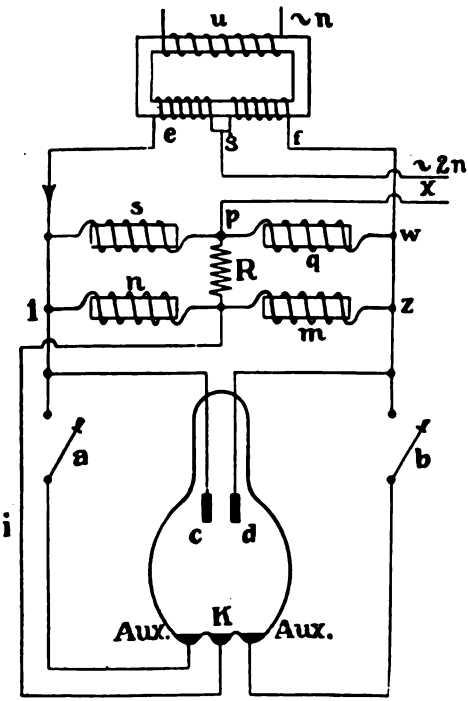


*Fig. 8*

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pressing the original electromotive forces.

To carry out this idea, we need only use an alternator having Y poles in the field, with the armature rotating U times per second. Then

$$n = \frac{UY}{2}.$$

If the armature has m conductors, the phase displacement of the electromotive force in each relative to the preceding will be $\frac{\pi Y}{m}$. Bouthillon has calculated that a machine could be built with the following characteristics: peripheral velocity of rotor = 196 meters per second, outer diameter of pole supports = 156 centimeters, 40 revolutions per second, 2,401 (= 49 x 49) turns on rotor, 49 pairs of poles, final frequency 96,040 cycles, corresponding to a wave length of 3,124 meters, rotor of solid steel, output 100 kilowatts. Such a machine, he states, could be built in any good electrical factory.

The desired overtones in the component electromotive forces are exaggerated by properly shaping the pole pieces, and by coupling suitable resonant circuits. The machines should be suitable for producing musical tones by the use of alternating current excitation, and are also applicable to the field of radio telephony.

We pass now to frequency transformers without moving parts. In the following we shall consider only such methods as deliver appreciable amounts of energy at a reasonable efficiency. The first we shall consider is the method described by Kruh (in American patent No. 787,193 of 1905). The somewhat complicated wiring diagram of the complete arrangement is shown in Fig. 8. At the bottom of the figure is the mercury arc rectifier on which the whole arrangement is dependent. It has two anodes c and d, one cathode K, and two auxiliary anodes for starting the arc. To ignite the arc the rectifier is tipped in one direction or the other, while the auxiliary lighting circuits are closed through the switches a, b. So soon as the current flow is established, the switches are opened, automatically or otherwise, and the normal operation of the arc between K and c, d begins. The two coils e, g and g, f are the halves of the secondary of a transformer, the primary u of which is supplied with a current of the fundamental frequency n. The four coils q, s, m, and n, are inductances, the connecting points of which are joined through the small resistance R. Between the points g and p can be drawn a current of double frequency. The explanation of the phenomena follows.

If, at any given time e is the positive end of the secondary of the transformer, current will flow through the anode c to the cathode K and thence to the point p where the current will pass through two alternative paths. One of these paths is to the double frequency circuit and the remaining portion of the current, after passing through the inductance q assists in magnetizing the core of the transformer. There is also stored in the core of the inductance q a certain amount of energy, and this energy storage continues until the peak of the positive path of the alternating current wave is reached. Thereafter, in accordance with Lenz's law the coil q tends to keep the current flowing in the positive direction. This discharge current of the choke coil q also has the choice of two paths. It may pass to the cathode K by means of the anode d and thence return to the point p through the circuit i. Another portion thereof will flow through the section f, g of the transformer secondary into the double frequency circuit and thence back to p.

It is to be noted that while the current amplitude was increasing, the current flow in the double frequency circuit was *away* from p, but that during the second half of the positive portion of the alternating current wave (that is, during the decrease of current amplitude) the direction of current flow in the double frequency circuit was *toward* the point p. Evidently then, during a half cycle of the primary current there is produced in the double frequency circuit a complete cycle of current changes. It is evident, therefore, that the device is a frequency changer. The function of the extra choke coils m and n is easily understood. The losses in the core of the inductance q during the time that its core is being magnetized are necessarily greater than

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during the time of its de-magnetization. A disymmetry in the double frequency current would be thereby produced, and this disymmetry is minimized by the use of the extra inductances m and n and the resistance R. The current through the inductances s and q is thereby made larger than the arc current. The resistance R also prevents the arc current passing into the double frequency circuit through the conductors l and z and then through i. A nearly uniform alternating double frequency current is thus produced. Inasmuch as it has been shown that mercury arc rectifiers can be operated at a good efficiency even at radio frequencies, it would seem that the method of Kruh might be applicable in radio work.

*The second and concluding installment of this article will appear in an early issue.*

## WIRELESS AND THE SUBMARINE

IN view of the activities of submarines in the European war and the uses to which wireless have been put when the underwater craft, attacked, an article by Lieutenant C. N Hinkamp, of the United States Navy, which appeared in the Journal of the American Society of Naval Engineers, is of especial interest. He points out that there is no mystery in connection with the operation of a submarine. Preparations to submerge include the stowing of the deck gear, taking down the bridge, unrigging the wireless telegraph gear, closing the hatches, unlocking the valve-operating mechanism and securing the engines. The time required for performing this operation varies from two to twenty minutes.

The crafts submerge in two ways, one being known as the static dive, or balancing, and the other as the running dive. In the static dive the boat is submerged, but does not move except in the vertical plane. This dive can be accomplished either by trimming the boat and maintaining the trim by adjusting her balance, or by dropping the anchor, trimming the boat to within a few hundred pounds positive buoyancy, and the heaving in or veering on the anchor cable. The latter way is the simpler method for easy control, and can be used where there is no current, or only a small amount of current, if the sea is not too rough. The craft is usually brought to a fore and aft trim before submerging. This will cause the boat to be level when submerged.

The running dive is made when the trimming tanks and auxiliary ballast tanks are flooded to the amount necessary for the proper trim when submerged, the main ballast tanks being empty. The submarine being under way "awash," the order to submerge is given. All hands get into the boat, the engines are stopped, and the electric motors started. As soon as the engines are stopped the conning tower is closed, all of the ventilators are housed, and the main ballast tank is flooded.

When submarine navigation was new, signalling under water was accomplished by tapping on a rivet with a hammer, and receiving by holding the forehead to a frame of the boat. Now the submarine bell, the Fessenden oscillator and the vibrating wire are used, and it is possible to signal under favorable conditions for more than five miles. These systems set up vibrations in the water which are detected by micraphones and heard through the ordinary telephone receiver.

## WRECKED VESSEL IS GIVEN QUICK AID

Off the treacherous coast of British Columbia, in the inner passage between Queen Charlotte and Milbank Sounds, the Mariposa owned by the Alaskan Steamship Company, sent out a wireless call for help at 7:30 in the morning of October 8. The SOS was caught by the steamship Despatch, her Marconi man receiving the disabled vessel's position as ashore on Pointer's Island. Within an hour the rescuing vessel arrived on the scene and a few minutes later had taken off all the passengers and proceeded to Ketchikan, where all were later landed safely.

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# The Wireless Telephone Tests

## Saying Hello to San Francisco from New York. Telephoning from Arlington to Honolulu. Views of Marconi and Others Regarding the Achievements

"HELLO, Carty. This is Mr. Vail." Thus spoke Theodore N. Vail, president of the American Telephone and Telegraph Company, as he sat at his desk in his office in New York City on the afternoon of September 29. His voice was not out of the ordinary.

In the wireless station of the United States Navy Yard at Mare Island, which is in San Francisco, California, approximately 2,500 miles from New York, was John J. Carty, chief engineer of the company. Over river, lake and mountain came to him Mr. Vail's voice, clear and distinct, the words being conveyed by means of wireless telephony, with the exception of the distance from New York to the wireless station at Arlington, Virginia. Immediately Carty replied, using the land line:

"This is fine! This is wonderful!"

The news of this achievement was overshadowed for the moment when it was announced later that a still more remarkable record had been made—the carrying of the human voice from Arlington to Pearl Island, near Honolulu, Hawaii, 4,900 miles away. Full of interest, too, was the word from Guglielmo Marconi that a trans-Atlantic wireless telephone service would be established as soon as the European war came to an end.

During the early spring of this year, as a result of the work already done, engineers talked over a distance of about 350 miles, using for the purpose an experimental tower which they had erected near Montauk Point, Long Island, and a small tower borrowed for the purpose from private owners at Wilmington, Delaware. Soon after that they talked over 1,000 miles, in this case using the experimental tower at Montauk Point and an experimental tower erected for the purpose at St. Simon's Island, Georgia. The results of these tests demonstrated the correctness of their work and steps were taken to try distances comparable with those involved in trans-atlantic telephony. Engineers had been conducting experiments in wireless from the Arlington station, too. On August 27, after preliminary experimenting, conversation by means of wireless telephony was held between Arlington and the naval station at Darien, the Isthmus of Panama.

It was exactly at forty-eight minutes after twelve o'clock when the first words between New York and Mare Island were spoken. The message went by land line to the Arlington station and then by wireless to Mare Island. Listeners at Mare Island said that the voices were distinct and recognizable.

The wireless telephone system had not yet been fully installed at Mare Island, the receiving apparatus only being in position there. It was impossible, therefore, for messages to be telephoned back by wireless, but all of the communications sent from or by way of the Arlington tower were recorded at Mare Island and their receipt confirmed by wire.

A number of men interested in wireless gathered at Arlington early in the morning. They included Captain W. H. G. Bullard, superintendent of the United States Radio Service, who gave his co-operation to the experiments leading up to the test; Colonel Samuel Reber, of the United States Army Signal Corps. and Dr. F. B. Jewett. Members of the party talked directly with those at Mare Island.

Within the next twelve hours reports of the test began to come from other places than Mare Island. San Diego, California, 2,300 miles from New York, reported that the messages from New York to Mare Island had been overheard by



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wireless. A similar report came later from Darien in the Isthmus of Panama, which is 2,100 miles from New York.

Then came word from Lloyd Espenchied, an engineer, in faraway Pearl Island. He sent a message saying that he had heard by wireless telephony words spoken at Arlington. At Pearl Harbor had been erected an antenna about 250 feet in length, the wires extending from the top of a smoke stack about 100 feet in height to the top of a water tank about eighty feet in height. The connection to the receiver was made by a lead from the smoke stack end, at right angles to the main aerial, to a pole thirty feet in height and 400 feet away. The full import of the word from Pearl Harbor can be appreciated better when it is realized that not only London, Paris and Berlin are nearer New York than Honolulu, but that the Hawaiian city is even farther away from the American metropolis than Petrograd.

In commenting on the recent tests Guglielmo Marconi said in an interview in London:

"There is not a shadow of doubt that wireless telephony across the Atlantic Ocean is assured in the future.

"While it is likely that the operators had to wait for advantageous atmospheric conditions, the fact that wireless telephoning was accomplished from Washington to Honolulu is extremely interesting. It does not matter if for the present such a result is possible only under ideal conditions. That talking over such a distance has been possible makes it certain that whatever obstacles may exist at present in the way of a fairly perfect service will be removed after further experiments.

"Had it not been for the war, which made it necessary to stop our experiments, we would probably have had a trans-Atlantic telephone wireless service by now. London might be talking over the telephone every day with New York.

"After the war a service will be installed as rapidly as we are able to do it. When that is accomplished London and New York will be within a half hour's conversational distance. It will undoubtedly be possible, once the system is going, to get into telephone communication with New York as easily as from New York to Chicago.

"Atmospheric disturbances must, of course, be taken into consideration. At

*Photograph of a group at Arlington interested in the wireless telephone tests. Some of those in the picture from left to right are P. G. Burton, J. E. Boisseau, Colonel Samuel Reber, of the United States Army; Lieutenant Commander S. E. Hooper, of the United States Navy; R. A. Heising, W. H. Schott, Lieutenant Bastedo, of the United States Navy; Lieutenant R. B. Coffman, of the United States Navy; J. Mills, and Captain W. H. G. Bullard, superintendent of the United States Radio Service*

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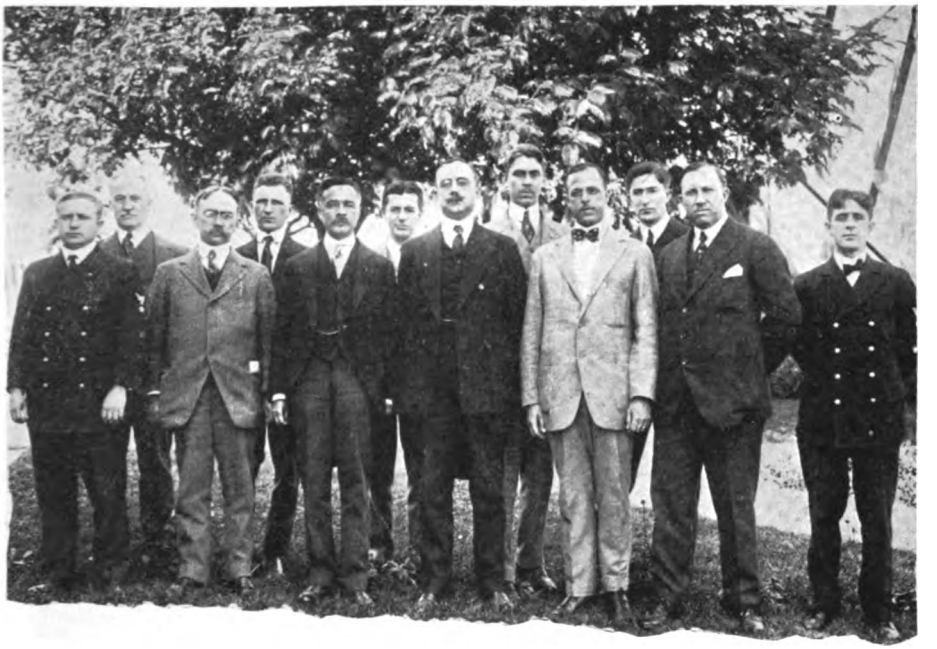

*A number of persons snapped by a photographer at the United States Navy Yard, Mare Island, during the tests. From left to right they are Chief Electrician Petersen, of the United States Navy; J. C. Marriott, official stenographer; A. H. Babcock, consulting engineer, the Southern Pacific Company; H. H. Linkins, J. J. Carty, chief engineer of the American Telephone and Telegraph Company; H. H. Hamlen, Lieutenant Commander G. C. Sweet, of the United States Navy; R. L. Shaw, H. D. Arnold, R. L. Hartley, A. H. Griswold, and Chief Wireless Operator Smith, of the United States Navy*

times they will delay the work of making connections and otherwise cause trouble. In the event of terrific storms at sea the wireless would work slower. But constant experiments ought to do a great deal to remove such difficulties.

"The time will come after the war when a man may take up a receiver in his London home or office, ask central to connect him with New York, and do his talking without any more effort than if he were in conversation over a wire with Paris. Wireless telephone messages would be communicated through a wireless station in London, transmitted direct to some coast station, received at a station on the Atlantic coast, and put through to the individual at the other end of the telephone with no break.

"An ordinary receiver such as is now used could be employed at each end. The voice would be as clear and distinct as if those talking were not separated by the ocean."

"The development of wireless telephony has occupied the attention of Mr. Marconi and his engineers for a number of years," said Edward J. Nally, vice-president and general manager of the Marconi Wireless Telegraph Company of America. "Successful communication by wireless telephony was conducted by him as early as 1912. In March, 1914, Mr. Marconi conducted tests on one of the Italian Government's war vessels commanded by the Duke of the Abruzzi and as a result of these successful tests the Italian Navy equipped a number of its warships with the Marconi wireless telephone. In July of last year Mr. Marconi predicted that the human voice would soon span the Atlantic Ocean by means of a wireless telephone; the tests conducted having convinced him that communication by wireless telephone over great distances is possible when suitable means are provided for generating the necessary radio frequency currents.

"The recent demonstration by the American Telephone and Telegraph

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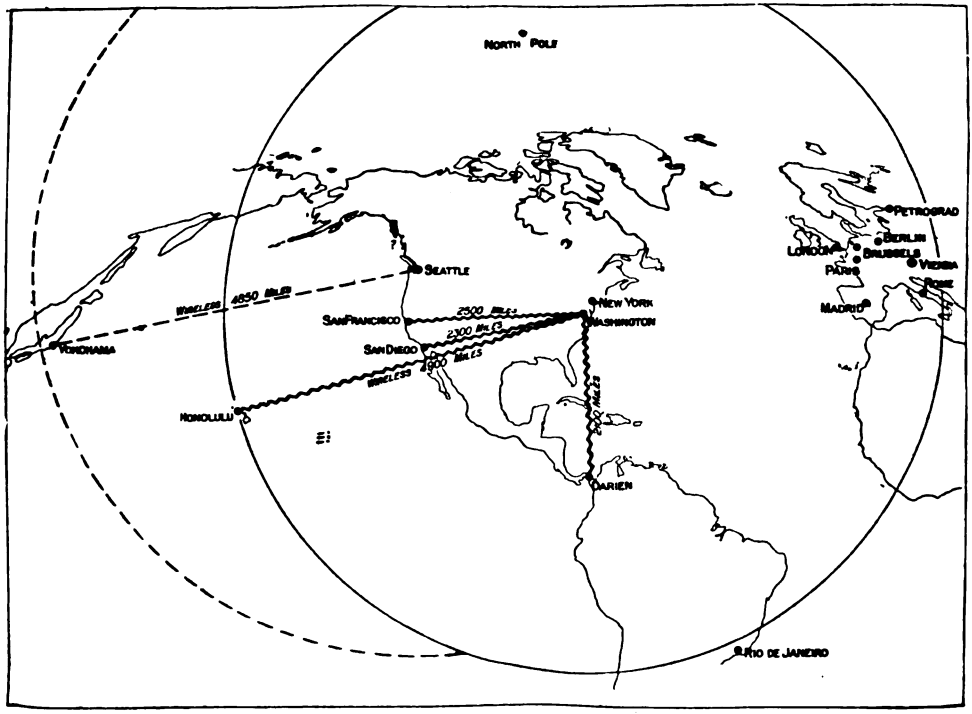
Company which employed the transmitting station at Arlington to enable it to communicate with San Francisco and later with Honolulu has drawn forth the discussion as to the arrangement and character of apparatus employed and the claimants for complimentary mention and for priority of invention are cropping up in many directions. A recent issue of The New York Times contains a letter from Professor A. N. Goldsmith of the College of the City of New York. In this letter Professor Goldsmith points out that the success of this experiment was largely due to the employment of an improved form of vacuum valve.

"Of course, it goes without saying that the improvements of Dr. Lodge and of Guglielmo Marconi in tuning the circuits are indispensible and of primary importance in wireless telephony as well as in wireless telegraphy. These patents, as is well known, have been in extensive litigation and have been uniformly sustained by the courts in this country, in Great Britain and on the Continent.

"Prior to 1904 a detector of the extremely minute electrical variations affecting the receiving apparatus was best exemplified in Marconi's magnetic detector or in the contact microphone, or perhaps in some electrolytic form of detector, but Professor Fleming of the College of the City of London pointed out that a vacuum chamber containing a hot element and a cold element was well adapted to receive and respond to these extremely minute oscillations of current; he also pointed out that the vacuum valve was a rectifyer of these oscillations and that it was well adapted for a detector in wireless signalling. Both before 1904 and subsequently, transmission and reception of vocal signals, that is, the variation in sound waves due to the vocal organs of the throat, were transmitted and received at limited distances and with expert care, but no such dis-




*Where the wireless telephone reaches. The main circle shows the territory within a radius from Washington of 4,900 miles, the distance from Washington to Honolulu, which was reached by a wireless telephone message. The same message could have been heard at a properly equipped wireless tower at any point within the circle. The dotted circle of equal radius shows that a telephone message from a wireless station at Seattle could be heard at Yokohama*

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*Theodore N. Vail speaking from New York to Mare Island, Cal.*

tance has been bridged as in the more recent demonstration.

"It is undoubtedly true that Professor Fleming's invention is the keystone of the arch on which this successful demonstration is supported. Many engineers and inventors have contributed and the advance has been accomplished as the result of many failures. Taking Professor Fleming's invention of the vacuum valve, as it is called, as the starting point, others have modified it with an element located within the vacuum chamber at a point intermediate between the hot and cold element, and this is considered a very useful special form of Professor Fleming's detector.

"The Fleming vacuum valve has been used by the American Telephone and Telegraph Company in its land line work and was very extensively employed as a repeater in the demonstration made on land lines between New York and San Francisco some time prior to the wireless demonstration above referred to. It is well known that that land line demonstration was founded on the invention of Professor Pupin who contributed the loading coil; it also involved the use of a composite circuit and much experience gained by experimental work. Without the vacuum valve of Fleming it would be impossible to telephone any such distance as indicated. Dr. Langmuir of the General Electric Company greatly improved the Fleming valve and Roy A. Weagant, chief engineer of the Marconi Company, has while working in the laboratory of that company, obtained much valuable data and information and has invented improvements which go far toward rendering the valve more practical, more constant and more useful as a commercial apparatus."

"Our experiments have been interrupted by the war, as our stations are now used for government work, but we have carried them far enough to know that undoubtedly after the war we shall be able to talk with New York," said Godfrey Isaacs, managing director of the English Marconi Company, in an interview in London. "We would now be talking across the Atlantic were it not for the war."

Professor Pupin said: "The greatest

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problem of all wireless work and particularly wireless telephony is the elimination of the effects of static disturbances. Every grounded system is acted upon by these forces. The Delaney system of wire telegraphy was a failure because of static influences. The Wheatstone system was successful because it solved this problem.

"The solution of the problem of overcoming static does not lie in increasing the sending power. This has been repeatedly tried only to fail. Owing to the necessity for secrecy at the present time, because of pending patents I am not at liberty to say just what the solution is. I will say, however, I have solved this problem. Theory, experimental results obtained in my laboratory and actual antenna results all agree exactly. There is absolutely no question regarding the successful operation of my discovery. It works both practically and theoretically."

# Talking From Arlington to Paris

Coming as the climax of a series of achievements in wireless telephony it was announced on October 21 that the human voice had been projected from the Arlington station in Virginia to the Eiffel Tower in Paris,—a distance of 3,800 miles. Words uttered at the Arlington station were distinctly heard at the Eiffel Tower, the accomplishment marking the first time that the Atlantic Ocean had been spanned by the human voice.

A. M. Curtis, who was at one time in the Marconi service, was sent with H. E. Shreve to Paris to make arrangements for the use of the Eiffel Tower station—a task which required several weeks due to the fact that the station is almost constantly employed as a result of the war. As it was, the American engineers were only permitted to use the station for a few minutes at a time and at periods far apart. Officers of the French Government were on hand in the Eiffel Tower while the tests were being made, and officers of the United States Army and Navy watched the experiments at Arlington.

Static conditions on the Atlantic were not good during the Arlington-Paris tests and reports show that great electrical disturbances prevailed in France during much of the time set aside for experimentation. The first signal from Arlington was caught by Shreve on the night of October 12.

Shreve heard the "Hello" of Webb at Arlington several times. Again, the following night, the words were heard and on the night of the 20th the words were again heard, not only in Paris, but in Honolulu by Lloyd Espenchied, who cabled that he heard the "Hello, Shreve" and the "Good-bye, Shreve," uttered by Webb in Arlington so plainly that he was able to recognize the voice as that of Webb. On the night of the 20th the French and American officers officially "listened in."

Because of the limited time at the disposal of the engineers at the Eiffel Tower it was necessary to cable the exact minute at which the plant would be available. Signals had been previously arranged, first by numbers, and then followed by the words. Shreve was instructed to cable what he got after each test—that is provided he got anything—and the signals were heard on three different nights. Owing to the fact that there was available only one set of transmitting instruments and that at Arlington, the talk necessarily had to be one sided.

## EDISON INTERESTED IN MAYFLOWER'S SET

During a recent trip Thomas Edison took on the Mayflower he expressed a desire to communicate with the Arlington. The following message was flashed to Captain Bullard, superintendent of the Naval Radio Service:

"Congratulations on your big Arlington plant. I have heard the small and large sets, seated in the wireless room of the Mayflower, and they are great."

In a few minutes the following reply was flashed back:

"My compliments to Mr. Edison and the Naval Advisory Board, by this message, transmitted on the 100-kilowatt spark set."

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# From and For those who help themselves

## Experimenters' Experiences.

*The editor of this department will give preferential attention to contributions from amateurs covering the design of transmitting sets, wave-meters, etc. There is an over-supply of material on receiving tuners, particularly "loose-couplers," the designs for the majority of which present nothing new or original.*

### FIRST PRIZE, TEN DOLLARS

### Details Regarding the Construction of a Panel Transmitting Set

I shall endeavor to describe a panel transmitting set which I am now constructing. The general scheme of arrangement for all of the apparatus should be plain from the accompanying drawing. It will be observed that in a compartment at the base of the cabinet a transformer of the open core type is mounted and held in place by wooden uprights. Of course, a closed core transformer might be employed, but the dimensions of the cabinet would have to be changed accordingly. Immediately above the transformer is mounted the condenser, which consists of the usual glass plates covered with tin-foil. These plates are held in place by supports which are fastened to the side of the case. Bakelite dilecto is the best material for this purpose. The supports should be placed as indicated in the drawing. For convenience, only seven of the plates are shown, but the actual condenser may require a number of additional plates. After trying a number of compounds, banana liquid was found to be the best for fastening the tin-foil to the glass. Electrical contact is made to the foil with an ordinary spring clip.

It will also be observed from the drawing that the oscillation transformer is of the pancake type. It is mounted on the front of the cabinet, the primary member being fastened to the front, but at a distance of ½ inch from the cabinet; the secondary member is hinged to the primary member. Care should be taken to have the hinge work tightly, otherwise the coupling between the two windings may not remain in a fixed position.

In constructing the oscillation transformer care should also be taken to have the turns spaced sufficiently apart to avoid disastrous sparking. I have found a bakelite base superior for insulation of the turns of this winding.

In the drawing the spark gap is indicated on the top of the cabinet, the actual type employed, of course, being optional with the builder. I personally use a rotary gap mounted on a little Fort Wayne fan motor.

The high potential terminals of the transformer have bakelite bushings, as indicated on the top of the cabinet. The primary terminals of the transformer are shown on the side. The connections are the ones usually employed in an amateur transmitting set.

The dimensions of this set are as follows: The case is of ½-inch oak, 15 inches by 12 inches by 7 inches, outside diameter, and 13 inches by 11 inches by 5½ inches, inside diameter.



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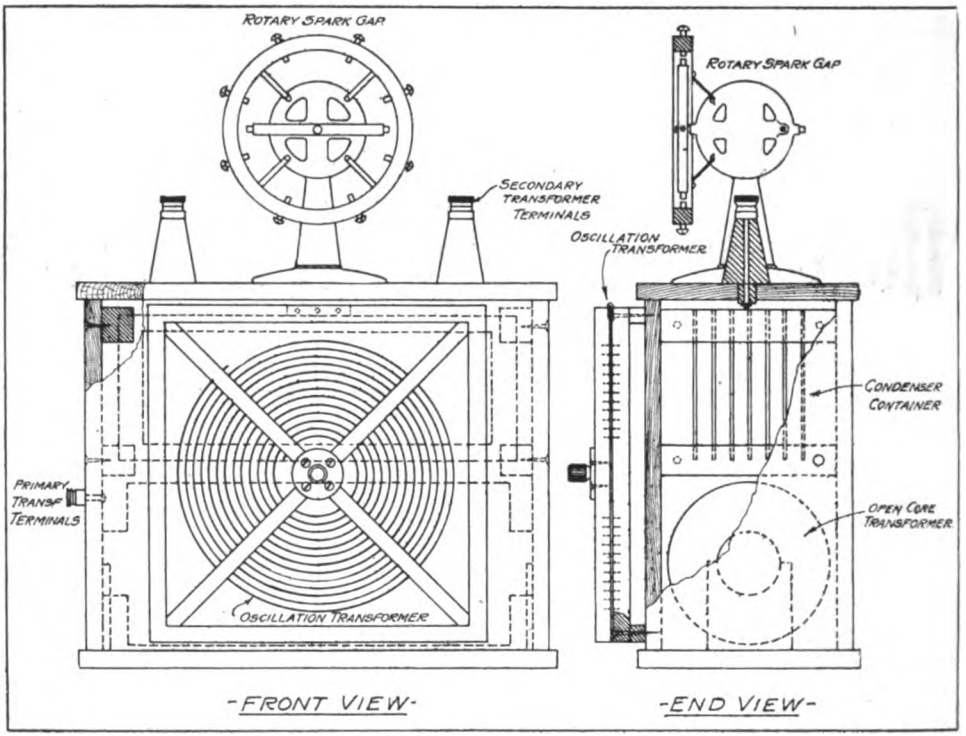


*Drawing, First Prize Article*

The transformer is about 13 inches in length by 5 inches in diameter, and has a capacity of ¼ k.w.

The condenser plates are 4½ inches by 12 inches, covered with tin-foil 3½ inches by 11 inches.

The glass plates are 3/32 of an inch in thickness. The condenser supports are 1 inch by 1 inch by 5½ inches. The frame for the oscillation transformer is made of ½ inch by ½ inch material, the extreme dimensions being 10½ inches by 10½ inches. The primary winding of the oscillation transformer has eleven turns spaced ¼ of an inch apart and made up of ¼-inch copper ribbon. A similar number of turns is used in the secondary winding. The spark gap motor shown in the drawing is 8 inches in height and has a bakelite ring 6 inches in diameter as a support for the stationary electrodes. The bakelite bushings referred to previously are 1½ inches in diameter at the bottom by ⅜ of an inch at the top and 2 inches in length.

Complete data for the individual apparatus is not given as the subject has been covered exhaustively in previous issues of THE WIRELESS AGE. In fact, I am indebted to this publication for the electrical constants for the greater part of the apparatus.

FRED WINKLER, JR., *New York.*

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## SECOND PRIZE, FIVE DOLLARS

### A Description of a Serviceable Electrically Operated Antenna Switch

It is a general custom in amateur wireless stations to install some type of hand-operated aerial changeover switch. This necessitates the placing of the switch within easy reach of the operator and generally in a position which requires undesirable length in the high tension lead connecting it with the transmitter. The switch described can be located anywhere in the station and controlled by two push buttons placed most convenient to the operator.

Fig. 1 is a front view of the mechanism under discussion. It consists essentially of a D. P. D. T. switch, J, with an

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extra pair of blades, D, $D_2$, and two solenoids, Q and $Q_1$. Instead of employing a stationary base and shifting connections by a movement of the blades in the ordinary manner, the four blades in this case are stationary and the base is raised to the right or left to engage the blades by means of two solenoids, such solenoids being energized by current fed in by either of the two push buttons located near the operator.

The extra pair of blades can be obtained from a D. P. S. T. switch and should be fastened to the pivots, F, $F_1$, as shown in Figs. 1 and 2. Two screws, E, $E_1$, pass through the two further blades, $D_2$, $D_3$, into the block, A, which,

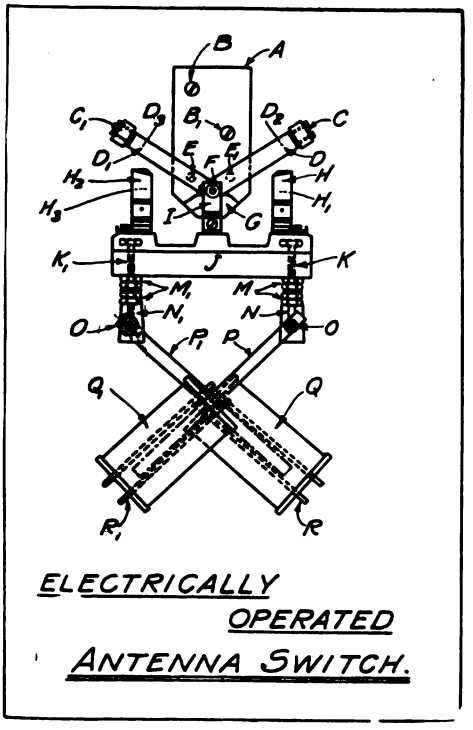


*Fig. 1, Second Prize Article*

in turn, is bolted to the base of the instrument. The base is fastened to a vertical support, such as the wall of the room, because the instrument is not designed to operate in a horizontal plane. Fig. 2 shows an end view of the switch and the method of mounting.

To give free motion to the base of the switch about its pivot, $F_1$, a portion of the block, A, should be cut away as indicated at G in Fig. 2. Two bolts, K, $K_1$, pass through the base between the poles of the switch. Two sets of four nuts, M, $M_1$, serve to hold in place two metal strips, N, $N_1$, shaped as in Fig. 2. The

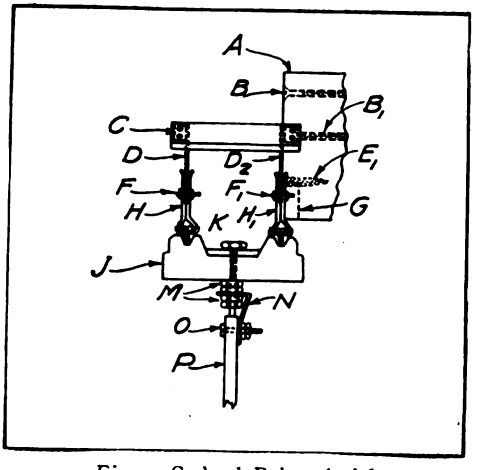

*Fig. 2, Second Prize Article*

soft iron plungers, P, $P_1$, of the solenoids, are pivoted to the strips as shown at O.

The internal diameter of the shells, R, $R_1$, of the solenoids, should not be less than ⅛ of an inch greater than that of the plungers to permit a slight vertical motion of the latter due to the circular path of the pivots, O, $O_1$. The solenoids

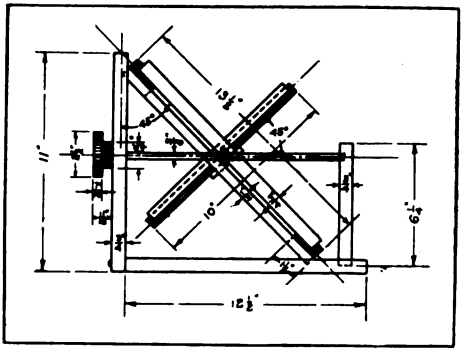

*Fig. 1, Third Prize Article*

are mounted on the base of the instrument one behind the other, their final relative positions being determined by experiment. They may be wound for 110 volts, but it is perhaps more conven-

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ient to connect them in series with a bank of lamps fed from the 110-volt A. C. mains. In this case fifteen layers of No. 22 D. C. C. wire per solenoid will prove satisfactory if 200 watts in lamps be consumed in the lamp bank. Two of the terminals (one of each solenoid) are joined together and connected with one side of the lamp bank. The remaining two terminals of the solenoids are led to the push buttons and connected, one to a contact of each. The two remaining contacts of the push buttons are joined together and connected with the other side of the lamp bank.

The switch connections are as usual. The antenna is connected to the outer blades, D, $D_1$, and the ground to the two inner blades, one of which, $D_2$, is shown in Fig. 2. The transmitter is connected by flexible cords to the poles, H, $H_1$, and the receiver to the poles, $H_2$, $H_3$.

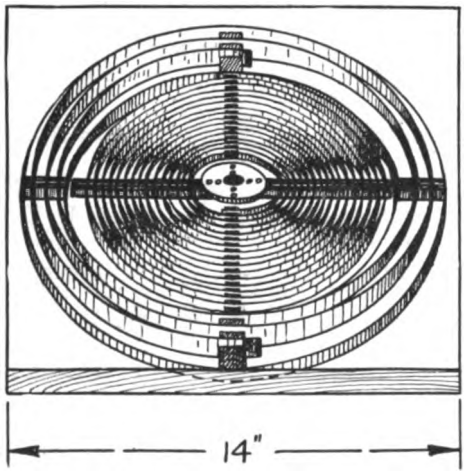


*Fig. 2, Third Prize Article*

The operation of the switch is as follows: To throw to "receiving" the operator merely presses that push button which is connected with the solenoid, $Q_1$. The latter will become energized and pull the plunger, P, downward. This will cause the base and poles of the switch to swing on the pivots, F, $F_1$, and connection will be made between poles, $H_2$, $H_3$, and their respective blades. To shift to "transmitting," the operator presses the push button which is connected to the solenoid, Q. This causes the base of the switch to swing on its pivot in such a manner that the receiving connections are broken and contact is made between the poles, H, $H_1$, and their respective blades.

A switch of this type has been installed in a 1 k.w. station and has proven most

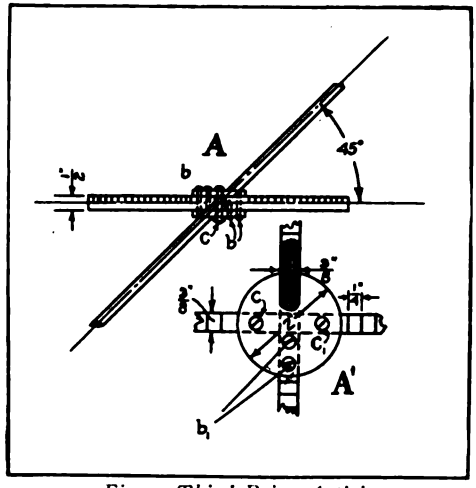


*Fig. 3, Third Prize Article*

satisfactory. Auxiliary contacts can be built into the instrument if desired. The chief value of this device lies in the ease and rapidity with which the operator can shift from transmitting to receiving and the fact that it can be so located that the length of the transmitting leads is reduced to a minimum—a decided advantage in view of the required 200 meter wave.

H. A. EVELETH, *California.*

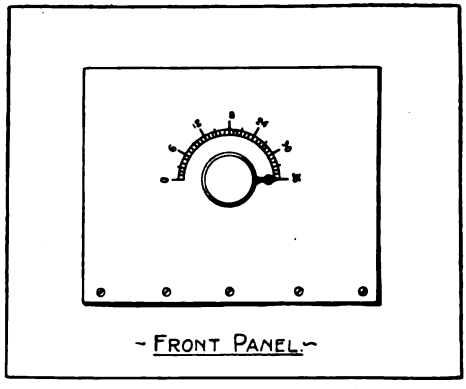


*Fig. 4, Third Prize Article*

## THIRD PRIZE, THREE DOLLARS

### This Oscillation Transformer Has Compactness and Efficiency

The Experimental Department of THE WIRELESS AGE has published many art-

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icles covering the design and construction of oscillation transformers, each being to some extent an improvement upon the other, but as yet I have failed to find any equal to the one I am about to describe for neatness, compactness and efficiency. Referring to Figs. 1 and 2, the front and bottom pieces are of mahogany, cut and finished to the following dimensions: ¾ of an inch by 11 inches by 14 inches and ¾ of an inch by 12½ inches by 14 inches, respectively. The back support is finished as shown in Fig. 5.

The primary winding of this transformer consists of 2½ turns of ¾-inch brass or copper ribbon, spaced ½ inch and set in hard rubber strips ½-inch square by 1½ inches in length. . Four of these strips are required. These are spaced equally about a base ½ inch in thickness by 1½ inches in width, 13½ inches outside diameter and 10½ inches inside diameter. When these details are complete they should be set up as shown in Figs. 1 and 2, at an angle of forty-five degrees. Fig. 2 has the base support removed for the sake of clearness.

Next obtain two pieces of hard rubber 10 inches in length by ½ inch by ⅜ of an inch in thickness and half lap their centers. Two pieces of hard rubber, 3/16 of an inch in thickness and 2 inches in diameter are then fastened above and below this joint with 8/32 inch machine screws, as indicated in Fig. 3. This construction is intended to be the form for the secondary winding and is to be wound with 15½ turns of ½-inch brass or copper ribbon spaced ¼ of an inch. The secondary winding is placed on a ⅜-inch round wooden rod through its center at an angle of forty-five degrees. The method is indicated in Figs. 1, 2 and 3 and particularly at A (Fig. 3). One end of this rod, or shaft, is placed in a ⅜-inch hole drilled in the front piece on a line with the center of both the primary and secondary windings, the other end being set in a hole drilled to a depth of ⅜ of an inch and a diameter of ⅜ of an inch. These are attached to the back support which is then fastened in place.

To continue the construction turn up a knob to the dimensions shown in Fig. 1 and fasten it to the shaft of the set screw. Mark off a scale on the front panel with a sharp tool and fill it with white lead which will show up distinctly.

To adjust the pointer on the scale, turn the secondary winding at a right angle to the primary winding and then fasten the knob to the shaft of the set screw at that position where the pointer is resting at zero. In Fig. 4 the pointer is shown as indicating maximum coupling. It will be observed that a half turn to the right will place the secondary winding parallel to the primary. It can readily be seen that this transformer can be adjusted to a nicety by the slightest turn of the knob over the scale, or the coupling can be varied from zero to maximum by a twist of the wrist.

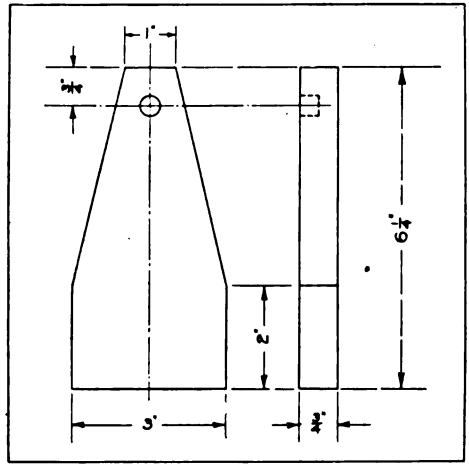


*Fig. 5, Third Prize Article*

FRANK M. O'NEILL, *California.*

## FOURTH PRIZE, SUBSCRIPTION TO THE WIRELESS AGE

### A Lightning Switch Which Costs Less Than a Dollar

In many cities the amateur is required by the underwriters to protect his station and apparatus from the danger of lightning by a proper grounding switch. The type of switch having a capacity of 100 amperes, generally procurable on the open market, is very expensive and not of the proper design for use in connection with amateur wireless telegraphy. It is mounted upon a slate base which, as

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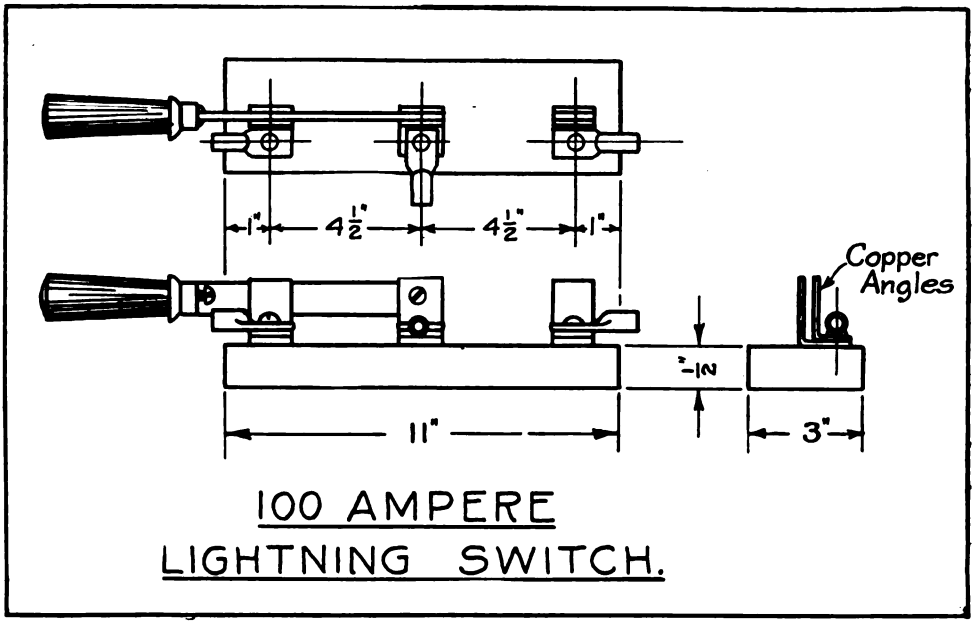
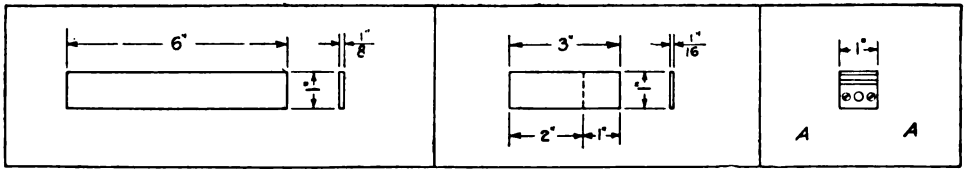



*Fig. 1, Fourth Prize Article*




*Figs. 2, 3 and 4, Fourth Prize Article*

is well known, is a conductor of high frequency current and in many cases will leak sufficiently to allow the antenna current to be shunted to the earth.

I have constructed a good lightning switch, according to the dimensions given in this article at a cost of less than $1. In addition the construction is very simple, requiring but little labor.

In Fig. 1 I have indicated three views of the finished switch. It will be observed that the size of the base is 11 inches by 3 inches by ½ inch. The dimensions for the copper blade, given in Fig. 2, are 6 inches by ⅞ of an inch by ⅛ of an inch, which is the size that will safely carry 100 amperes as specified by the insurance rules.

For the switch clips it will be necessary to purchase 18 inches of copper strip having a width of 1 inch and a thickness of 1/16 of an inch. These clips are made in a novel manner. The strip is cut into 3-inch lengths, each length being marked as shown in Fig. 3. It is then placed in a vise so that the jaws grip just below the line placed 1 inch from the end of the strip. A right angle bend is made on the line. Six of these copper angles are made and placed two together to form three clips as shown in Fig. 4. The clips are fastened to the switch base by the screws, AA, so that the slots are directly over the center line. The large center hole is bored through the clip and a base with a 3/16-inch drill to hold the lugs. Lugs of such size as will accommodate a No. 4 wire which will just fit the base of the clip are selected. They will lie flat on the clip base when the flat head screws, A, are countersunk.

The switch blade is provided with a

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handle as shown in Fig. 5. It may be turned out of wood to the size shown and countersunk to hold the connecting nut B. A hole, C, is drilled in the blade, D, to a depth of ¼ of an inch; the sides are squared and the slot, E, made with a hack saw. The switch handle can now be fastened to the blade.

The completed switch should be mounted outside of the station and operated from a window or other convenient opening. In addition to satisfying the underwriters' requirements, it will amply repay the small expense necessary for its construction in rendering the wireless station safe from lightning storms.

J. B. BRADY, *Maryland.*

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## HONORARY MENTION

### The Armstrong Circuits for the Amplification of Signals

It is a surprising fact that very little is known in the amateur field concerning the Armstrong circuits for the amplification of wireless telegraph signals. By means of the diagram of connections which are fully covered in the Proceedings of the Institute of Radio Engineers for September, 1915, the range of the receiving station can be almost doubled. The Armstrong circuits are, of course, applicable to the vacuum valve only and are equally suitable to either damped or undamped oscillations, being more easily adjusted than the ordinary double or triple vacuum valve amplifier connections.

To make this circuit effective for amateur purposes the only unusual apparatus required is the inductively-coupled oscillation transformer, L, $L_1$, interposed between the grid and wing circuits of the vacuum valve. The larger coil, L, is 5 inches in diameter by 4 inches in length, wound closely with No. 26 S. C. C. wire. The inner coil is 4 inches in diameter and 4½ inches in length, wound full with the same sized wire. The two coils are arranged so that the coupling can be varied as desired. A small condenser, $C_3$, having a capacity of about .0001 microfarad, must be placed in series with the grid. This condenser can be made by coating two, three or four photographic plates with tin-foil, leaving a margin of ¾ of an inch. The complete apparatus should be wired up as shown in Fig. 1.

In adjusting this apparatus to a distant station, the primary winding should be set at the wave-length desired; then, after the coupling between the wing and secondary circuits has been tightened, a click will be heard. This indicates that a vacuum valve is generating undamped oscillations. The coupling between the wing and secondary circuits is then decreased until a hissing note is produced. The set is now in its most sensitive condition for a certain station.

During the first trial a little difficulty may be experienced in tuning, but the operation will soon become self-evident. If the vacuum valve will not oscillate, the connection to one of the coupling coils should be reversed.

An alternative method is shown in Fig. 2. The inductance in the wing circuit, $L_1$, may be a coil 5 inches in diameter by 4 inches in length, covered with No. 26 wire. The small fixed condenser, $C_3$, has the same value of capacity described with the diagram of connections (Fig. 1). With this connection the major portion of the tuning is done at the secondary condenser and the necessary fine adjustments are made at the condenser connected in shunt to the head telephone. The author finds the latter method much less sensitive and more difficult to place in adjustment.

A. E. HARPER, *New York.*

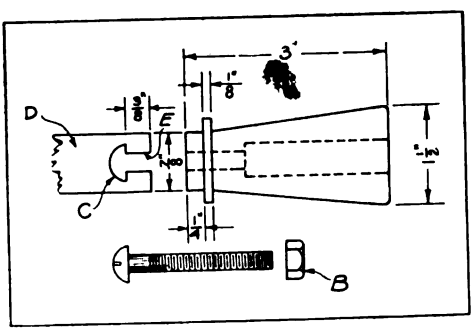


*Fig. 5, Fourth Prize Article*

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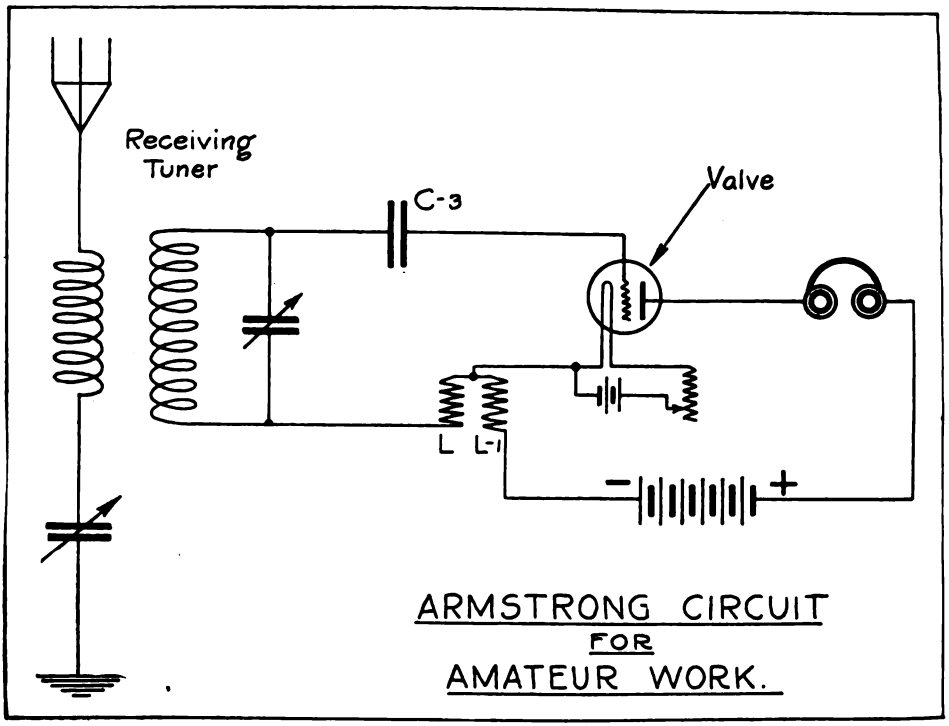


*Fig. 1, Honorary Mention Article,*
*A. E. Harper*

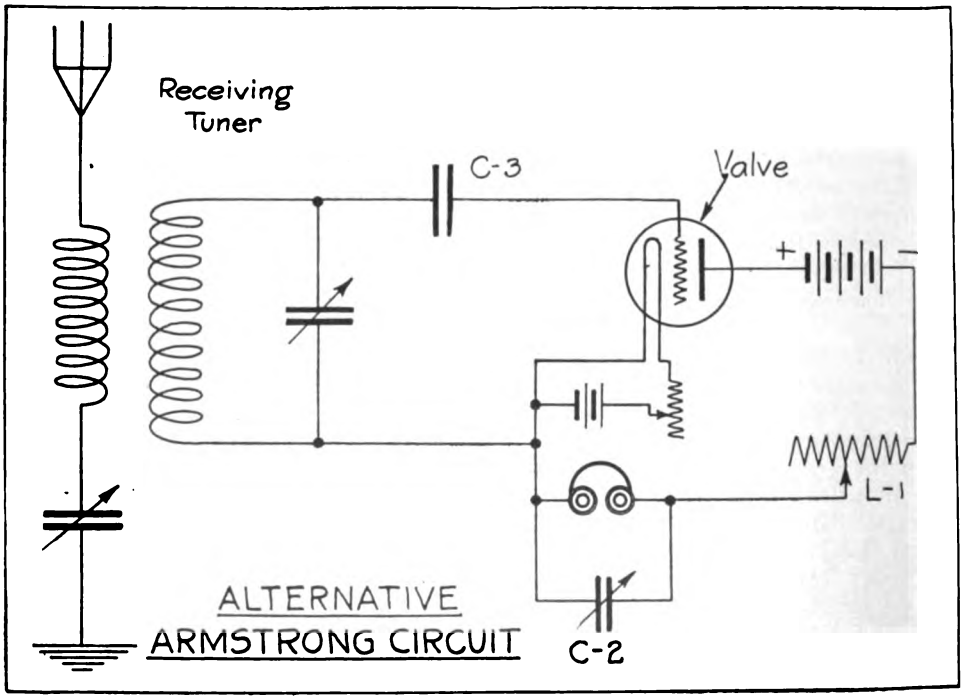


*Fig. 2, Honorary Mention Article,*
*A. E. Harper*

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## HONORARY MENTION

### Metal Suitable for the Mounting of Crystalline Detectors

I find it unnecessary to purchase at an exorbitant price a number of substances for compounding a soft metal suitable for the mounting of crystalline detectors. Tin amalgam used in the place of the general run of fusible alloys will afford a better degree of conductivity and allow the removal or replacing of crystals without the application of heat, and can be used over and over again without employing anything but the hands to mold it.

Tin amalgam can be prepared by putting a few drops of mercury in a dish and adding small pieces of thin, pure tin-foil. Do not use the tin-foil generally employed for transmitting condensers, as it forms large particles which do not harden so readily as that of a finer texture. When the mixture is made thick enough and tightly packed around the crystal it will harden in a short time. During the process of formation, the mercury will go to the bottom of the pan, leaving the hard tin. To use it over again, simply take it out of the holder and knead it with the fingers; whereupon it will be found in its original condition.

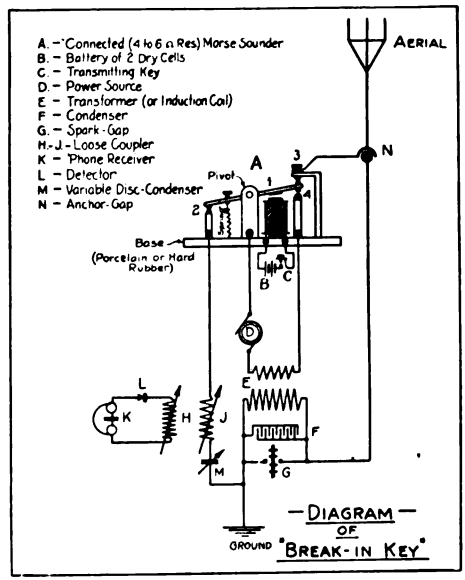
It is not advisable to purchase crystals one at a time because they have been branded as "tested." It has been found preferable to buy an ounce or so of any of the well-known types from which a good selection can generally be made in the following manner: To test quickly and without trouble, take a sheet of ordinary tin-foil and connect it to one terminal of the receiving tuner circuit. The second terminal of the receiving tuner circuit should terminate in a piece of picture wire. With a large number of minerals lying on the tin-foil, the wire is run over them, one at a time, the good ones being picked out as they are found sensitive. In this manner it is possible to run over several ounces of mineral in a very few minutes.

H. SAMUEL MEYER, *Illinois.*

## HONORARY MENTION

### A "Break-in" Key Which Gives Satisfactory Results

A diagram of a "break-in" key which I constructed by making a few alterations on an ordinary (4 ohm) Morse sounder should be of interest to the readers of The Wireless Age. I have obtained excellent results in using it. For the contacts heavy copper studs are used. They can be improved by soldering a dime to each contact surface. When the key, C, is at rest the lever, 1, of the sounder, A, will rest on contacts 2 and 3, being held in that position by the tension spring; thus the receiving circuit is closed. The anchor gap, N, in the aerial, cuts


A. – Connected (4 to 6 ohms Res) Morse Sounder
B. – Battery of 2 Dry Cells
C. – Transmitting Key
D. – Power Source
E. – Transformer (or Induction Coil)
F. – Condenser
G. – Spark-Gap
H-J. – Loose Coupler
K. – 'Phone Receiver
L. – Detector
M. – Variable Disc-Condenser
N. – Anchor-Gap
AERIAL
Pivot
Base (Porcelain or Hard Rubber)
GROUND
– DIAGRAM – OF "BREAK-IN KEY"

*Drawing, Honorary Mention Article, Philip Vogel*

out the direct ground. When the key, C, is pressed down, the lever, 1, will touch contact 4 and close the primary sending circuit through the pivot of the lever and through the primary winding of the transformer. Therefore, while transmitting (of course keeping the phones on the head) interference caused by another station, or stations, or a break signal from the receiving operator can easily be detected.

PHILIP VOGEL, *New Jersey.*

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## VESSELS RECENTLY EQUIPPED WITH MARCONI APPARATUS

| Names | Owners | Call Letters |
|---|---|---|
| Pioneer | Standard Oil Company of New Jersey | KIG |
| Brindilla | Standard Oil Company of New Jersey | KTZ |
| Moreni | Standard Oil Company of New Jersey | KNX |
| Cushing | Standard Oil Company of New Jersey | KSC |
| Dayton | Standard Oil Company of New Jersey | KNP |
| Caddo | Standard Oil Company of New Jersey | KSK |
| Glenpool | Standard Oil Company of New Jersey | KOH |
| Baton Rouge | Standard Oil Company of New Jersey | KSG |
| Polarine | Standard Oil Company of New Jersey | KOI |
| Communipaw | Standard Oil Company of New Jersey | KOE |
| De Soto | Standard Oil Company of New Jersey | KNI |
| Muskogee | Standard Oil Company of New Jersey | KIB |
| Corning | Standard Oil Company of New Jersey | KIH |
| Petrolite | Standard Oil Company of New Jersey | KIF |
| Gold Shell | Gold Shell Steamship Company | WIB |
| Clan Macbeth | Clan Line | YIY |

## THE SHARE MARKET

New York, October 27.

American Marconi holds strong. The market has been strengthened by the news that Telefunken wireless apparatus would be removed from twenty-two ships of the Standard Oil Company of New Jersey and replaced by Marconi sets, the agreement between the Standard Oil Company and the Marconi Company to run for a number of years. There is considerable activity in English Marconis, but they are still low. There is no concensus of opinion as to the reasons for this condition, although the traders agree that they ought to sell higher. Canadian Marconi is dull, due to the fact, traders declare, that because of the war silence is being maintained concerning the new Canadian stations.

Bid and asked prices to-day:

America, 4¼—4½; Canadian, 1⅜—1⅝; English common, 9½—12½; English preferred, 8½—11½.

## SERVICE ITEMS

P. C. Ringgold, who was secretary to T. M. Stevens, superintendent of the Southern Division of the Marconi Wireless Telegraph Company of America, with headquarters in Baltimore, Md., has been transferred to New York as secretary to George S. DeSousa, traffic manager of the Marconi Company.

C. W. Leber who was manager of the cost and sales department of the Marconi Wireless Telegraph Company of America, has resigned.

Roy A. Weagant has been appointed chief engineer of the Marconi Wireless Telegraph Company of America to succeed Frederick M. Sammis, who has resigned.

Lee Lemon of the Marconi Telegraph Company of America, left New York recently to visit stations in the Gulf Division.

H. E. Campbell, who has been engineer-in-charge at the Marconi New Brunswick station, has been detailed to duty at the Bolinas station. N. E. Albee, who was manager of the Cape Hatteras station, has been transferred to New Brunswick.

## CLARENCE B. SMITH WEDS

Miss Georgianna Mae Axt and Clarence B. Smith, assistant treasurer and assistant auditor of the Marconi Wireless Telegraph Company of America, were married on October 20 at the home of the bride's parents in Passaic, N. J. Mr. Smith's associates in the Marconi offices in New York presented the couple with a silver tea service. Mr. and Mrs. Smith visited the South on their honeymoon. Mr. Smith has been in the service of the Marconi Company for the last three years.

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# The Wireless Operator's Future

By William A. Winterbottom.

IN the early days of wireless, shortly after Mr. Marconi had successfully demonstrated his ability to communicate 30 miles without wires, the call came for wireless operators. Conditions in England then, as now, were somewhat different to those existing in the United States. The telegraph service being a Government monopoly, telegraphists were more or less bound to their Civil Service or Government positions, and the idea of severing relations to engage in such a new and untried profession as wireless, in the hands of a newly formed Marconi Company, was not received with great enthusiasm.

Advertisements were inserted in the provincial newspapers for telegraphists to operate wireless apparatus, and a few venturesome spirits grasped the opportunity. To-day their names are found high in the executive offices of the many Marconi Companies.

The salaries offered to Marconi operators in those days were not magnificent—£1 ($5) per week, with an extra allowance of 50 cents per day for shore service—"but," as the local superintendent urged, "what opportunities to travel and see the world! The finest Atlantic liners to travel upon!"—for in those days few steamers were fitted. "Wonderful opportunities for ambitious youths," and similar encouraging remarks were repeatedly emphasized. And all of these were undoubtedly true, although not particularly effective, as the small salary was often the stumbling block to any but young men. It is very different now; even salary conditions have improved wonderfully since those early days, and we now find the American Marconi Company paying its ship operators from $25 to $60 per month, depending upon the length of service and ability.

Many young men deeply interested in wireless progress still hesitate, however. Says one: "My heart and soul are in wireless, my happiest hours are spent with my home-built equipment, and every improvement holds me closer to the art, but, while I would enjoy a year or two at sea, some day I should prefer to settle down on terra firma. While ships sail the seas, wireless men must accompany them, and I therefore seek a living in other directions and ride my wireless hobby during spare time."

Says another—and I am rather inclined to believe he is a shortsighted young man: "What future is there in wireless for me? I cannot afford to spend the best years of my life at sea in the hope that some day I might be promoted to a land station or possibly to a position in the home office. The chances are too much in favor of remaining a ship operator." And so he gives his best thoughts to wireless telegraphy as a pastime instead of seriously considering its advantages as one of the progressive and promising professions available to-day.

Let it be my privilege to remove some errroneous views.

Wireless telegraphy has been making wonderful progress within the past year or two in its real sphere which, as this magazine's readers know, is long distance telegraphy in competition with older and more expensive methods. The best informed men in the wireless profession agree that the future of wireless is in long distance communication. The ordinary wire and cable means of communication have almost doubled each succeeding decade. The field for an additional, more rapid and more economical agency is therefore limitless.

Already the first trans-oceanic link between Great Britain and Canada is working with wonderful regularity and surprisingly accuracy. The public is gradually becoming aware that Marconi serv-


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*The hotels attached to high power wireless stations are the last word in comfort and convenience; lounging rooms for operators off duty are a feature*

ice is "just as good and far cheaper" than cable service.

We also find the first link in the Marconi Trans-Pacific chain—California to Hawaii—operating with the precision of a landline without the constant fear of losing the conductor. The Japanese Government is now testing with the Marconi high power duplex stations in Hawaii over a distance of 4,000 miles and congratulatory messages have already passed between the Japanese Imperial officials and the Marconi Company's executives. The service will be opened to the public very shortly, and the urgent cry is for competent operators.

Stations costing millions of dollars have been erected at Belmar and New Brunswick in New Jersey, to communicate at high speed with similar stations in Great Britain, and equally powerful stations are located at Chatham and Marion, in Massachusetts. The latter stations will communicate with Stavanger, Norway and Sweden, Denmark and Russia will be added to the circuit. These stations, as is generally known, are awaiting the cessation of European hostilities before commencing operations. The Massachusetts and New Jersey stations are now being connected by wire with the Marconi main telegraph office at 42 Broad Street, New York, where a large staff of expert operators will be required.

Other high power wireless stations undoubtedly will be built in other parts of the American continent. We may expect to see the West Indies and that wonderful field south of the Panama Canal dotted with busy Marconi stations.

Each of the stations mentioned will require a large staff of operators for continuous service. Supervisors and superintendents will be needed. Engineers and their assistants will find excellent positions awaiting them.

Conditions of living at high power stations are the last word in comfort and convenience. Most of the stations are situated near to some large civic center and a regular trip to town or theatre is quite possible. Naturally the stations are in close proximity to some body of water where bathing, fishing and boating afford much diversion. Tennis courts are provided and there is ample ground available for baseball diamonds and football-fields. Even golf might not be put out of the question at some of the stations.

The hotels attached to these huge

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plants are objects of wonder to all visitors. Operators are given well furnished bedrooms with adjoining baths; there are lounging and music rooms holding player-pianos and Victrolas with splendid selections of records, besides a well-stocked library which circulates through all stations. Smoking rooms are fitted with restful lounging chairs and on many winter nights these are drawn up to form a cosy half circle about the large open fireplaces. The dining rooms are run solely for the convenience of operators and service may be had by those coming off duty at any hour of the day or night. Billiard tables are found very popular, and bowling alleys in the hotel basements are promised.

We also find that high power men, on account of continuous duty, are rewarded with four weeks' vacation with full pay, and sick pay while unable to perform active duty. A benefit association has recently been organized providing protection to families in case of death.

"How different," comments the young wireless operator, "to life in small wooden shacks that a few years ago might have passed for barns but for the tell-tale aerial. Have salaries improved in the same ratio as the living conditions?"

The salaries have kept pace with the increasing importance of the traffic handled. Young operators, who are competent, are now enrolled for high power work usually at $90.00 per month, increasing according to their ability and length of service to $120.00; and more lucrative positions are numerous.

"But how may I become sufficiently expert to hope for such desirable positions?" asks the youth, now more interested than ever.

Such positions are, of course, not secured without hard work. Only the ambitious and most expert may hope for heavy assignments. "Holding down" a continuously busy circuit at high speed, handling practically nothing but difficult code and cipher language, is not to be compared with most ship assignments. Few steamers produce sufficient traffic to call for the steady grind of a long distance circuit, where wasted minutes are calculated in lost dollars.

High grade men competent to fill these new positions are not numerous. Special training is essential, and it is for this purpose that the Marconi Company recently opened an additional school. Here the practical side of telegraphy is thoroughly taught. Graduates to this school must first have completed the regular wireless course as taught in the Marconi school at present. A Government certificate is necessary. Many of the students complete their wireless course, secure a license, and are assigned to the Marine Division. During the days that their ships are in port they will be found attending the new school, becoming familiar with long distance methods, so that when the call for high power station men is made they will be capable and ready to secure advancement. The secondary course, it is estimated, will occupy about one year. Students in this class are first examined in such subjects as geography, arithmetic, handwriting, orthography, composition. If this examination is successfully passed, a medical certificate is required, indicating the applicant's general good health and fitness for foreign service.

*Pleasant hours of recreation on nearby waters are graphically portrayed by this picture of a twenty-eight-pound sea bass caught in front of Marconi hotel at Marshall, Cal.*

Young men who formerly hesitated over the question of wireless as life work are now preparing themselves for the many lucrative positions to be filled with the opening and extension of the Marconi long distance services.

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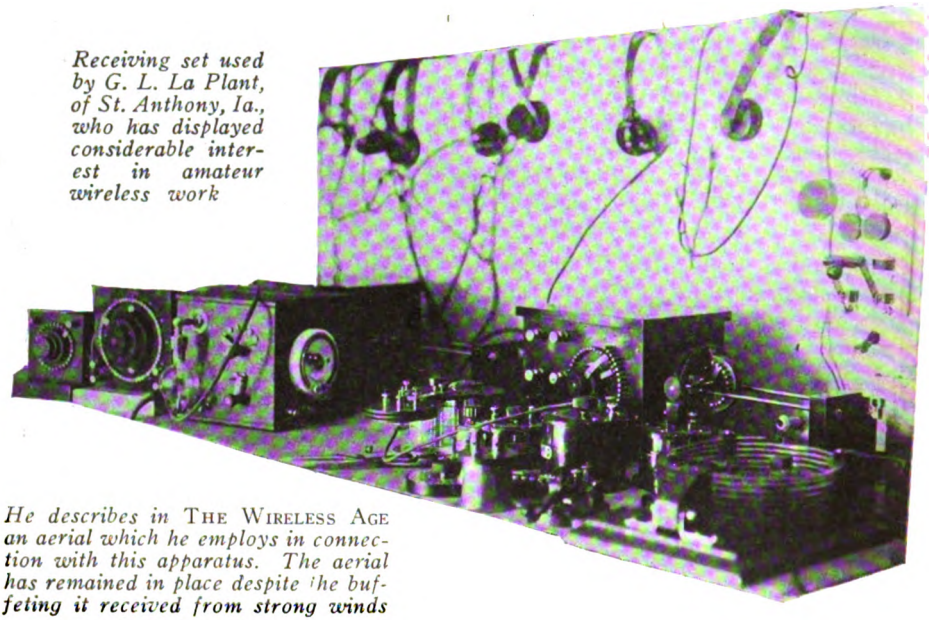
# With the Amateurs



*Receiving set used by G. L. La Plant, of St. Anthony, Ia., who has displayed considerable interest in amateur wireless work*

*He describes in* THE WIRELESS AGE *an aerial which he employs in connection with this apparatus. The aerial has remained in place despite the buffeting it received from strong winds*

G. L. La Plant has sent to THE WIRELESS AGE details of a plan which he followed for the construction of the aerial support at his station in St. Anthony, Ia.

The aerial is preferably erected on 1½-inch or 2-inch gas pipe mast, the latter size being used for his 80-foot aerial. The method of construction is as follows:

Secure a large size auger and unscrew the handle. In place of the handle screw a large piece of gas pipe, 14 feet to 16 feet in length. Pipe wrenches can be employed advantageously for turning the auger. After this single section of pipe is placed in the hole and a pulley and rope has been attached to the top section, the second section should be screwed into the first one.

In the event that the aerial is erected near a building, as is generally the case, the pulley is placed in the gable of the structure, near the mast.

Mr. La Plant attached four guy wires to each joint and, with the aid of several boys, easily hoisted the aerial into place. It has not come down despite the buffeting received from strong winds.

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The October meeting of The Radio Club of America was held on Saturday evening, October 9th at eight o'clock, in room 304, Fayweather Hall, Columbia University, New York City. Fritz Lowenstein presented a paper on "Quenched Spark Sets." Mr. Lowenstein described in detail the principles, design and operation of sets of this type, discussing from a critical standpoint many recent developments in the general theory of transmission as applied to quenched spark apparatus.

Messrs. John L. Hogan, Jr., Emil J. Simon, M. E. Packman and G. T. Eltz were the chief participants in the discussion.

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The amateurs of Troy, N. Y., and the



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vicinity have formed an association known as the Amateur Marconi Radio Association. The club, which was organized about eight months ago, has a membership of approximately thirty persons.

The officers of the Association are as follows: President, Wendell King, vice-president, William Robbins; secretary Harold Connor; treasurer, Everett Barnes. The Association would be interested to hear from all amateurs in and near Troy. Communications should be addressed to the treasurer No. 827 Third avenue, North Troy, N. Y.

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The school in the Young Men's Christian Association Building in New Orleans for the training of commercial operators was formally opened recently. The school is fitted with a Marconi equipment similar to the type of sets used on large ocean liners. The instructors of the day and night classes are Warren C. Graham and T. George Deiler.

The Vineland High School Radio Association of Vineland, N. J., was organized recently. Leslie H. Adams was elected president; Firman A. DeMaris, third vice-president; Franklin Lamb, secretary and Frank M. Comfort, treasurer and advisory president.

Through the courtesy of the Board of Education the Association has obtained permanent rooms in the new Vocational High School.

The aerial will be about 100 feet in height and 250 feet in length. The set will consist of a ½ k.w. transmitting set and a receiving set of a standard make.

The association would like to get into communication with other clubs. All correspondence should be sent to Franklin Lamb, No. 623 Elmer street, Vineland, N. J.

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The amateurs of Boston and vicinity are planning to form an organization. Persons interested in the movement are invited to make inquiries at the Young Men's Christian Union, 48 Boylston Street, Boston.

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The Topeka Radio Club was organized about a year ago its purpose being to promote and regulate wireless activities in and around Topeka. Six members of the club, have obtained government radio licenses. At a recent meeting the following officers were elected for 1915-16: President, E. Broberg; vice-president, J. Keating; secretary and treasurer, W. Beasley; sergeant-at-arms, R. Moorhouse.

All correspondence should be addressed to the Secretary William A. Beasley, 1517 Western avenue, Topeka, Kas.

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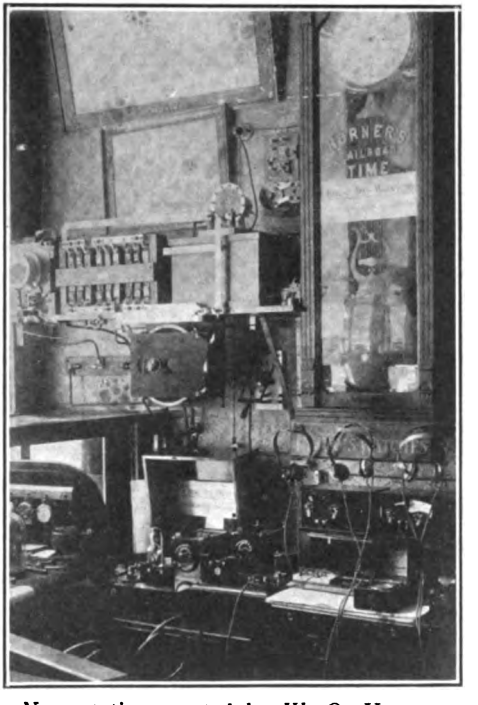
W. O. Horner, a jeweler of Cleveland, Tenn., has erected a new station. He writes that he uses a 1 k.w. Clapp East-



*New station erected by W. O. Horner*

ern transformer, a rotary gap, a condenser, an improved hot wire meter and a wave-meter. His receiver is of the triple valve type and during the winter months he has heard the NAA time signals ninety feet from the phones. He uses a pair of amplifying receivers to great advantage. The accompanying photograph shows his station.

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The Experimental Radio Association has been organized to promote intercommunication between amateurs residing in the District of Columbia. The club already owns a wave-meter and con-

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templates the purchase of more apparatus. Amateurs holding operators' licenses are invited to join. Applicants should communicate with John H. Alden, No. 124 Bryant street N. W., Washington, D. C.

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In a recent issue of THE WIRELESS AGE there appeared a list of a number of the special stations in the ninth radio district. The balance of the list can be found in the radio service bulletins of the Department of Commerce and Labor.

The special stations in the Central Radio Association are as follows: 9XR, Tri-City Radio Laboratory, Rock Island, Ill.; 9ZS, Illinois Watch Company, Springfield, Ill.; 9ZK, Harry J. E. Knotts, Illiopolis, Ill.; 9XL, Burlington High School, Burlington, Ia.; 9VA, Iowa State University, Iowa City, Ia.; 9XP, University of Kansas, Lawrence, Kans.; 9YE, Wichita Telegraph School, Wichita, Kans.; 9ZE, Claude Sweeney, Minneapolis, Minn.; 9XK, R. R. Moore, Kansas City, Mo.; 9XN, University of North Dakota, Grand Forks, N. D.; 9YG, North Dakota Agricultural College.

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The amateurs of Cincinnati, Ohio, have organized the East Night High School Radio Society. One of the objects of the organization is to train its members to be able to render effective assistance in time of emergency; another is to prepare them to qualify for United States' Government commercial operators' licenses.

Pupils in other schools who are in sympathy with the aims of the society are invited to correspond with H. Fender, secretary of the East Night High School Radio Society, Cincinnati, Ohio, with the object of forming a relay association.

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An invitation has been extended to boys to join the Junior American Guard, the object of which is to promote a proper regard for discipline, obedience and military instruction. Instruction will be given in military tactics, engineering, first aid, signalling, wireless telegraphy, marksmanship and the playing of drum, fife and bugle.

Since its organization last May the membership of the Guard has reached 3,000. At the head of the organization is Brigadier General Andrew C. Zabriskie, a Seventh Regiment veteran and a former member of the governor's staff. Second in command is Major William H. Elliott, formerly of the Boy Scouts. Headquarters have been established at No. 52 Beaver street, New York City.

Charles F. White, of No. 117 East 127th street, New York City, wishes to hear from boys between twelve and eighteen years of age, especially those interested in wireless telegraphy, for the purpose of organizing a Radio and Signal Corps. Information will gladly be furnished to anyone who wishes to organize a corps in or outside of New York City.

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Frederick D. Northland, secretary of the Chicago Wireless Association, said recently in a letter: "Generally speaking, amateurs have to contend with a good deal. One may ask, 'What good are we?' or another dub us a bunch of 'nuts.' Passing up the christening, I claim that the amateur has proved himself of value to the community. In order to obtain his license he must pass a strict government examination, itstall apparatus to conform to government regulations and pass fire underwriters' rules, while those having first grade licenses operate on lake steamers during the summer. Only by experimentation and practice can new discoveries be made and instruments perfected. For these a great number of patents have been credited to the amateurs in this country. In case of war an army of about 2,000 licensed amateur radio operators could be called upon."

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## NOW TRANS-PACIFIC MEN

The Marconi Wireless Telegraph Company of America recently transferred a number of specially trained wireless operators from New York to its trans-Pacific stations, where they will be employed in the service to be inaugurated with the Japanese Government telegraph system. The men transferred are William H. Barsby, R. P. Woodford, Michael Svendon and J. J. Lynch.

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# Marconi Men

## The Gossip of Divisions

### Eastern Division

L. C. Driver has been assigned to the Santa Cecilia, and will make a long trip south.

C. S. Gould has been transferred to the Philadelphia of the Red D Line.

V. H. Rand is junior on the Finland.

A. C. Armstrong has relieved J. S. Farquharson as junior on the Florizel.

Max Kanter is on the Jamestown.

C. L. Beach, who spent more than a year on the Arapahoe, has been promoted and is now in charge on the Saratoga. P. H. Krieger is junior.

Henry Markoe and Fred Llewellyn are on the Arapahoe.

F. W. Harper, a Pacific Coast man, is running out of New York on the Rio Grande.

B. A. Hampe is junior on the Carolina. William Varitoni of the Marconi School of Instruction succeeded him on the North Star.

J. W. Harte is on the Howick Hall making a voyage to Chile.

The steamer Korea of the International Mercantile Marine has been transferred to this division with her operators, T. V. Griffin and A. R. Short, of the Pacific Coast.

W. J. Meekin is attched to the Pioneer, one of the newly equipped Standard Oil vessels.

F. Hues is on the Santa Cruz. Joseph Welch took his place on the City of Memphis.

R. H. Fleming is junior on the Antilles.

M. H. Hammerley is attached to the Standard Oil ship Moreni.

J. Lohman has relieved C. R. Underhill as junior on the City of St. Louis. Underhill goes to the El Alba.

H. L. Goff, who has just returned from Holland, is junior on the Comanche.

George Abbott is on duty on the Lewis Luckenbach, a one-man ship running through the canal.

H. C. Bigelman has relieved F. S. Monschau on the Brilliant.

T. B. Illingworth of the Marconi School of Instruction is junior on the El Occidente.

H. McKiernan, one of the wireless operators of the Denver, which was wrecked in mid-ocean, is at present attached to the Larimer.

L. Martinez is junior on the Concho.

Matt Bergin is senior on the Brazos.

Samuel Schneider is chief on the Jefferson.

Operator Y de Bellefeuille is in charge of the Siberia, one of the five vessels formerly owned by the Pacific Mail Steamship Company and purchased by the International Mercantile Marine, which is being transferred to this division. His assistant is S. Rudonett.

E. R. Hanna is attached to the Llama.

H. L. Crandall is senior on the El Cid.

Walter Oliver, a brother of George Oliver, has entered the Marconi service, being attached to the El Rio. He is a graduate of the Marconi School of Instruction.

C. F. Hawkins and A. C. Olsen have been detailed on the Maracaibo as senior and junior.

R. Raggie has been assigned to one of the newly-equipped Standard Oil ships, the Glenpool.

W. W. Jablonsky, a new man, is attached to the El Sol.

J. A. Bossen has been promoted and is now senior of the Jamestown.

W. H. Boyle is senior of the City of Savannah.

E. Graff has been assigned to the Santa Rosalia.

J. S. Merrill has re-entered the service. He is junior on the City of Savannah.

O. P. Angell is attached to the City of Rockland.

A. R. Morton is on the Bay State.

A. W. Mayer has been assigned to the Gov. Cobb.

W. J. Swett has been placed on the Nacoochee.

### Great Lakes Divison

C. D. Heinlen and C. K. Kneale, senior and junior respectively, have conclud



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ed their work for the season on the Juniata. Heinlen contemplates a hunting trip in the wilds of Minnesota, while Kneale has returned to his school work.

G. M. Commerford and E. Leonard, senior and junior respectively, have completed the wireless season on the Octorara. Commerford has been assigned as junior on the City of Cleveland III., vice D. Smith. E. Leonard has left for his home.

The City of Detroit III has been laid up for the season. C. J. Hiller, the senior operator, has been detailed on the Eastern States, a one-man ship, while R. Sidnell, the junior operator, left for his home for a short visit.

The wireless season on the Tionesta ended recently. H. N. Umbarger and William Kunnar, the operators, have left for their homes.

W. V. Cram has been appointed to the Arizona, vice R. Matthews.

F. C. Fisher, of the Georgia, has been replaced by H. M. Junker.

E. A. Nicholas has been re-engaged, having been assigned to the M. & B. No. 1, vice R. C. Hough, resigned.

S. R. Henry is now on the Harvester, a one-man ship, vice M. F. Klicpera.

O. R. Redfern, constructor, of Duluth, recently completed a trip to Isle Royal, Mich.

F. C. Goulding has been assigned to one of the A. A. boats as purser and operator.

One trick at Buffalo has been done away with, due to the laying up of vessels. Manager John Hankin has been transferred to the night watch. William McBride, who was detailed on the night trick, has gone home for a short visit.

The Mackinac Island station has been closed for the year. D. A. Nichols, manager has returned to his school duties, while E. Johnson, second operator, has left for New Orleans to work in the Gulf Division.

L. C. Dent, chief operator of the Lake Michigan district, recently left for West Virginia, on his vacation.

W. H. Biesemeyer, manager of the Manitowoc station, has left for New Orleans. McDonald, formerly third at Chicago, has been promoted to manager of Manitowoc.

A. Thomas, manager of the Chicago station, recently returned from his vocation.

Duluth station was made a one-man job on account of the laying up of vessels. E. W. Schulthise, night operator, contemplates going farther north for the winter months.

**Southern Division**

E. P. Hough, recently operator of the San Jumarn, has been transferred to the Georgiana at Savannah, Ga., relieving Operator G. H. Fischer.

Operator Henry Simons has been assigned to the Delaware Sun at Philadelphia.

H. A. Miller of the Mexicana, has been assigned to the Essex as senior operator. H. J. Sacker has been assigned as junior.

S. P. Smith, junior operator of the Kershaw, has been transferred to the C. A. Canfield at Philadelphia, relieving Operator McDonald. The vacancy on the Kershaw was filled by J. F. Onens of Philadelphia.

Manager and Mrs. W. P. Kent have returned to the Jacksonville, Fla., station, after spending a month's leave in Wallingford, Pa.

W. J. Phillips who has been doing relief duty at the Jacksonville station, has been transferred to the Miami, Fla., station to relieve the operators there during their vacations.

O. S. Ferson of the Miami station is on a two weeks' vacation.

The Powhatan of the Merchants' and Miners' Transportation Company, has been laid up for several weeks for repairs.

L. W. Passano, who was junior operator of the Somerset, was recently assigned to the Ligonier at Jacksonville. His place on the Somerset has been filled by J. E. Kane, of Jacksonville.

Levon Asadorian, a new man in the service, was recently placed aboard the Paraguay at Philadelphia.

R. E. Armstrong has been detailed to the Savannah, Ga., station to relieve Operator D. Brietenbach and Manager G. E. McEwen, respectively, during their vacations.

C. B. Ellsworth, recently junior operator on the Howard, is now junior operator of the Olivette. His place on the Howard was filled by W. Q. Ranft.

A. Tomasso was recently transferred

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from the Ossabaw to the Toledo, relieving Operator P. Hickman.

### Pacific Coast Division

A. A. Dezardo has relieved J. G. Kelley as assistant of the Aroline.

M. L. Bergin and A. S. Cresse, first and assistant respectively, of the Camino, were recently relieved at New York, as the vessel was scheduled to carry one man only. S. J. Morgan, who left San Francisco on the Leelanaw, was assigned to bring the Camino west. Morgan was on the Leelanaw when that vessel was torpedoed off the English coast.

N. McGovern has been assigned as operator in charge of the Celilo, relieving S. Rudonett, who was detailed as assistant on the Siberia.

J. L. Slater has relieved L. Winser, as assistant on the City of Topeka. Winser is now enjoying a short vacation at Bakersfield.

E. V. Baldwin and J. W. Anderson have been detailed as first and assistant of the City of Para.

S. M. Armacost has been assigned to the Colonel E. L. Drake, relieving Operator K. E. Soderstrom, who was stricken suddenly with appendicitis, and is now in a Seattle hospital.

S. Gaskey has been assigned to the Georgian.

F. Wiese has been assigned as assistant on the Governor.

D. M. Taylor and D. W. Kennedy have been assigned as first and assistant on the Great Northern.

C. Bentley recently relieved Operator W. H. Barsby on the Honolulu. Barsby was transferred to the Marshall High Power station.

G. F. Roberts has relieved J. H. Baxter, as wireless operator and purser, of the Hilonian. Baxter has been transferred to the Astoria Marine station.

L. J. Gerlach has relieved S. J. Richardson as assistant of the Klamath. F. V. Griffin and A. R. Short have been detailed as first and assistant of the Korea. The Korea left for London, via the Panama Canal.

L. O. Marsteller has joined the Lurline as operator in charge.

H. L. Edling and L. W. Stevens have joined the Multnomah, as first and assistant, respectively.

C. T. Nichols has been assigned as assistant of the Matsonia.

The Mills, of the General Petroleum Company has been transferred to the San Francisco district with Operator A. G. Simson in charge.

K. D. Noble and C. D. Wheelock have joined the Northland as first and assistant.

J. A. Stirling has been assigned as assistant of the Persia.

H. Burrows has joined the Pennsylvania, as assistant. J. M. Chapple is in charge.

C. A. R. Lindh and C. Bailey are acting first and assistant of the President.

J. M. Flottman and F. M. Gill are first and assistant of the Queen.

A. Seidl has joined the San Ramon. W. R. Chesebrough is acting assistant.

A. Koch and J. Beard, recently sailed on the Willamette, as first and assistant.

W. R. Gompf has sailed as assistant on the Wilhelmina. Gompf will replace E. N. Pickerill, at the Honolulu High Power station. Pickerill will return on the Wilhelmina.

B. R. Jones has joined the Yucatan.

### Seattle Staff Changes

A. Boots, the veteran of the Northern Division, has been transferred from the Spokane to the office at Ketchikan.

A. E. Marr is now on the Senator, running to Nome.

L. W. LeBarron, a new man in the service, has left the Pavlof and joined the Umatilla as junior operator.

R. A. Billadeau, second man on the Senator, has been transferred to the Paris.

Emery Lee, who spent the summer on the tanker Mills and the Alaskan trader Alliance, has resumed his studies at the University of Washington. R. M. Ryan, senior man on the Alliance during the past summer, has also returned to the University of Washington.

C. A. Hohlbein, second on the Admiral Evans, is now on the Alliance, with R. J. Scott as first.

W. W. McLaughlin, late of the United States Signal Corps, has joined the Marconi service. He has been appointed second operator on the Admiral Evans.

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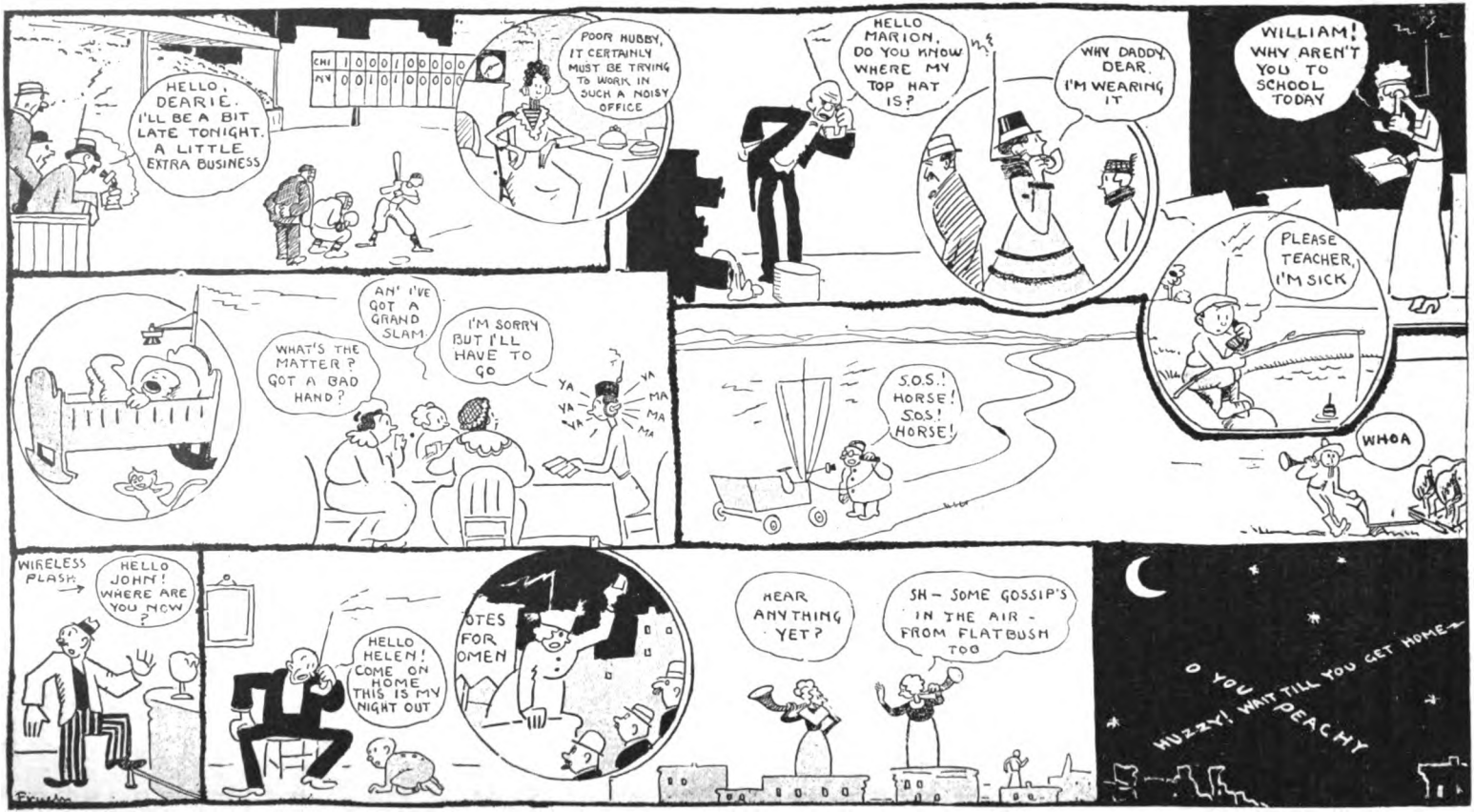
# The New Wireless Telephone

## An Artist's Idea of How Its Operations May Be Popularized


HELLO, DEARIE. I'LL BE A BIT LATE TONIGHT. A LITTLE EXTRA BUSINESS
POOR HUBBY, IT CERTAINLY MUST BE TRYING TO WORK IN SUCH A NOISY OFFICE
HELLO MARION, DO YOU KNOW WHERE MY TOP HAT IS?
WHY DADDY DEAR, I'M WEARING IT
WILLIAM! WHY AREN'T YOU TO SCHOOL TODAY
PLEASE TEACHER, I'M SICK
WHAT'S THE MATTER? GOT A BAD HAND?
AN' I'VE GOT A GRAND SLAM
I'M SORRY BUT I'LL HAVE TO GO
YA MA
S.O.S.! HORSE! SOS! HORSE!
WHOA
WIRELESS FLASH
HELLO JOHN! WHERE ARE YOU NOW?
HELLO HELEN! COME ON HOME THIS IS MY NIGHT OUT
OTES FOR OMEN
HEAR ANYTHING YET?
SH – SOME GOSSIP'S IN THE AIR – FROM FLATBUSH TOO
O YOU PEACHY
WUZZY! WAIT TILL YOU GET HOME

*From The New York World*

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# RADIO RAVINGS

*Conducted by D. Phecriff Inslater*

Anxious Reader: Yes, it is announced that eventually by means of wireless telephony you will be able to 'phone your husband's office, no matter where it is located—even if it is in Paris and your home is in New York. You will readily see the advantage of the wireless telephone if, for instance, you wish to get advance information regarding the Paris styles or want him to do a little shopping for you. As every wife knows, the best time to telephone to a husband on subjects of that kind is during business hours. Don't pay any attention to the operator if you are told that your husband is in an important conference—insist upon talking to him. Your suggestion that messages from wives to their husbands' offices take precedence over all other wireless telephone business is an excellent one.

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**Possible Uses of the Wireless Telephone**

Telling the haberdasher's clerk exactly what you think of him after discovering when well started on an ocean voyage that he has given you size 15¼ of the only style collar you like instead of your regular size, 14¾.

Informing your neighbor, who is a professional pugilist, just what it is about him that displeases you. Provided the pugilist lives in the United States, it is advisable for you to conduct this conversation from some point in the Sahara desert.

Breaking the news to your wife that you have changed your mind about giving up smoking in order that she may buy more hats. Select any place 2,500 miles from your home.

Telling the boss that you *must* have your salary raised. Use your own judgment as to distance.

Asking the girl's father if he'd like to have you for a son-in-law. The distance depends on the father's temper.

Inviting your friend who believes that he is well informed regarding politics to drop in on you and give you his views on national issues, he of course being in New York and you in Honolulu.

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Wonder, by the way, what we'll substitute for "Get off the wire."

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No, Minerva, the wireless telephone will not be taboo by the politicians because there are no wires to pull. And it wouldn't be a good business stroke to have England, Germany and France on a "party line."

---

Newspaper says that the wireless telephone is another triumph for science. Glad to hear of a victory now and then that is not won by the Allies or Germany.

---

Overheard by a wireless operator at the gangway:

"I wish you'd move your luggage. I can hardly find room to stand."

"Move my luggage? Why, those are my feet!"

"Is that so? Then perhaps you would be kind enough to pile them one above the other."

---

**Be Modern**

If you'd like to spend some time in jail
Don't "bean" a guy or swipe his kale.
Don't go to work and hire some thugs
Or shoot a man, then swear you're bugs.
Just tune up a set to six hundred or so,
Then hook in a coil and let her go.
Call a coast station with an M S G,
And say you're a ship far out at sea.
Tell 'em of fire, of icebergs or strife,
Tell 'em to hurry to save your life,
Conclude with the letters S O S,
Then playfully give them your home address.
Make a few dashes, some dots and a K,
And you'll soon be en route to Atlanta, Ga.

Ralph A. Sayres.


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# Queries Answered

**Answers will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all letters and only one side of the paper written on; where diagrams are necessary they must be on a separate sheet and drawn with India ink. Not more than five questions of an individual can be answered. To receive attention these rules must be rigidly observed.**

## Positively no Questions Answered by Mail

G. C. C., Pittsburgh, Pa.:

Ans.—(1) The laboratories of the National Electric Signaling Company are located in the Bush Terminal Building, Brooklyn, New York.

Ans.—(2) The type of earth connection preferable for wireless telegraph work depends upon the local conditions. It is generally the custom for amateurs to connect their apparatus to earth through the medium of steam or water pipes or any other available metallic capacity. If the station is located in a steel building, it will only be necessary to connect the earth lead of the transmitting or receiving apparatus direct to the frame. If your apparatus is so located that it is necessary to construct a special ground connection, it is suggested, for transmitting purposes, that a copper plate having 250 square feet of surface be buried in the earth for a distance of 4 or 5 feet, preferably so deep that the plate will be constantly covered with moist earth. It is essential that the leads from the transmitting apparatus to the actual earth capacity be made of stout copper wire.

* * *

W. G., Dawson, Yukon, Canada, writes that he has erected two poles, 85 feet in height, separated by a space of 100 feet, and has attached thereto a six-wire antenna for receiving purposes. He further states that although the United States Army station at Fort Gibbon is but ninety miles distant, he is unable to receive its signals. This, he believes, is due to the fact that it is practically impossible in Alaska to get a moist earth connection, the ground being constantly frozen and the temperature ranging from ten to seventy degrees below zero. He uses a counterpoise consisting of 500 feet of galvanized iron wire spread over the grass and ground, joined to a piece of zinc roofing which is buried in the earth. He also includes a brief description of the receiving apparatus, but does not go sufficiently into the details to enable us to determine the probable effectiveness of the set.

Ans.—If the receiving apparatus employed is efficient, sensitive and properly connected up the trouble must lie in the earth connection. A counterpoise consisting simply of 500 feet of galvanized wire is probably insufficient to act as an earth connection. A number of copper wires should be laid radially over the surface of the earth from the station, extending in all directions so as to include, let us say, 4,000 to 6,000 square feet of earth surface. Each wire need not be more than from 50 to 80 feet in length and should be preferably started from a point directly underneath the flat top aerial.

* * *

A. A A., Sandy Hook, N. J., inquires:

Ques.—(1) How can the capacity in microfarads of an inverted L type antenna be measured without the use of instruments?

Ans.—(1) Secure a copy of the publication issued by the Bureau of Standards, containing an article by L. Cohen, which fully covers this subject. A similar article appeared in the Electrician for February, 1913.

Ques.—(2) If a variable air condenser be filled with condenser oil, to what extent will the capacity in microfarads be increased?

Ans.—(2) The actual increase in capacity depends upon the specific inductive capacity of the insulating medium. For example, castor oil is rated as having about four and one-half times the specific value of air at ordinary pressures.

* * *

E. H. A., Boone, Ia., writes:

Ques.—(1) Please tell me if it is possible to take a lead off both ends of an aerial so that two stations can receive simultanously. Another amateur has a pole located about 250 yards from my pole and we have an excellent opportunity to erect a long aerial for receiving from high power stations. Is this idea practical?

Ans.—(1) Without doubt wireless telegraph signals could be received from nearby stations, but the arrangement, considered as a whole, is not practical. By this manner of connection the antenna system becomes a "looped" aerial and any variation made in the tuning elements of one receiving system will seriously affect the operation of the other. We strongly advise against this arrangement.

* * *

H. E C., Atlantic City, N. J., says:

Ques.—(1) I am using an independent vibrator with thirty volts, ten amperes, direct current, and I am experiencing considerable trouble with the points arcing. Can you suggest a method for overcoming this?

Ans.—(1) The points of this vibrator should be of pure platinum, perfectly smooth and evenly faced. Perhaps the condenser in shunt to the vibrator contact has insufficient



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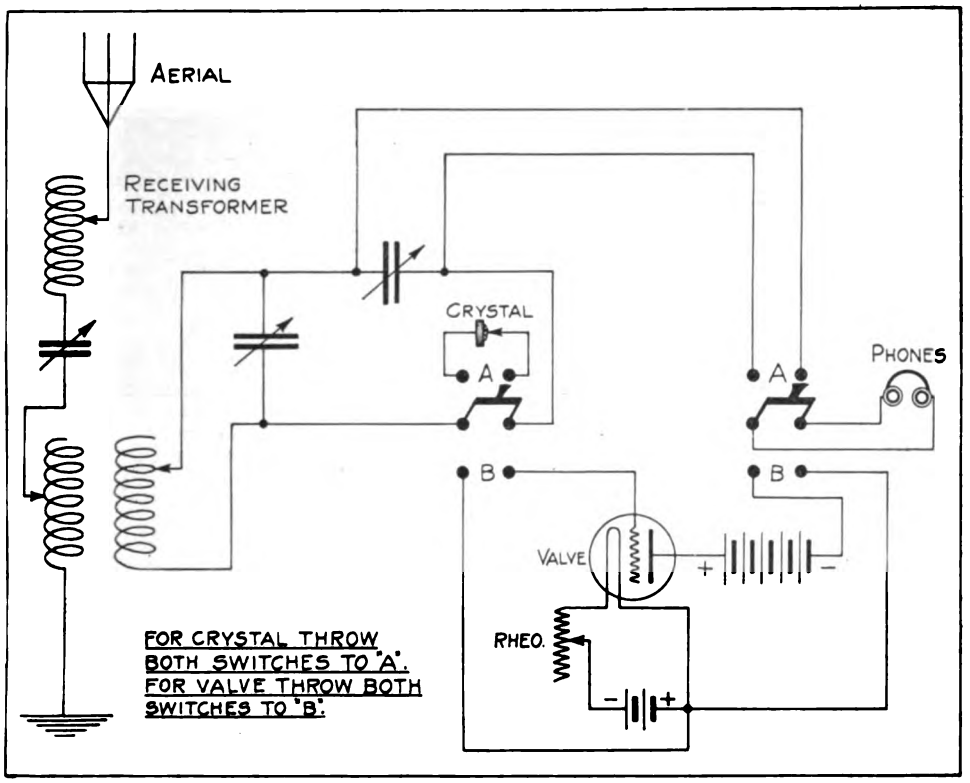


*Fig. 1*

capacity. It should have a value of from fifteen to thirty microfarads.

* * *

W. W. M., San Francisco, Cal., writes:

Ques.—(1) Describe the Fleming valve.

Ans.—(1) See the reply to R. J.'s inquiry in this issue.

Ques.—(2) What is the average life of these bulbs?

Ans.—(2) Generally about 600 hours.

We do not know exactly to what the exhibitor in charge of the wireless exhibit at the Panama-Pacific Exposition referred to, but it is a fact that aerials of considerable length do not possess the tuneable qualities that are obtained by antennæ of shorter length. This is due to the fact that such aerials have a high value of resistance and likewise re-radiate considerable of the energy picked up from the passing electromagnetic waves. Owing to the absence of a concentrated value of inductance in such aerials for given wave-lengths, the decrement of damping is greater than if a smaller aerial were employed with a considerable value of localized inductance connected in series.

In Fig. 1 is shown a complete diagram of connections for the three-element vacuum valve and mineral detector with the necessary changeover switches for connection from one to the other.

W. C. (no address given) asks us a number of questions concerning his receiving apparatus, particularly in regard to reception of signals from Arlington. An amateur in his neighborhood is able to receive these signals with considerable strength, but at the station owned by the questioner they are barely audible. The latter also sends us a diagram of connections for the receiver which we find to be perfectly satisfactory and the most efficient method of connection that could be devised. It would appear from the description that W. C.'s inductively coupled receiving tuner is too large for the satisfactory reception of Arlington signals and will, in reality, permit wave-length adjustments up to 4,500 or, possibly, 5,000 meters. The primary winding of his receiving transformer should be covered with No. 24 S.S.C. wire and the secondary with No. 30 or No. 32. For the reception of Arlington signals the primary winding may be made on the same tube, namely 5 inches in diameter, which should be wound for a distance of 4 inches with the No. 24 wire. The secondary winding need not be more than 4½ inches in length by 4½ inches in diameter, wound closely with No. 30 wire.

* * *

W. B., Lima, Ohio:

The dimensions of a receiving tuner for the efficient reception of 200 to 300 meter wave-

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lengths are fully given in the article in the series, "How to Conduct a Radio Club," in the September number of THE WIRELESS AGE. In that article a portable receiving set of the exact dimensions for the maximum strength of signals in connection with crystalline detectors was described. Inasmuch as your aerial has a natural wave-length of 214 meters, a variable condenser in series with the antenna system is required in order that the receiving apparatus may be adjusted to the wave-lengths of amateur stations.

You are quite correct in your belief that there is a certain time element that must be taken into consideration in the design of non-synchronous rotary spark gaps. We advise a

C. A. S., Allentown, Pa.:

The Fleming valve is described in the inquiry of R. J., Eureka, Cal., in the "Queries Answered" department in this issue. Two sets of batteries may be used with the valve if desired, but if the diagram of connection as shown in Fig. 2 is employed one set of batteries will be sufficient. Please observe carefully the diagram and the dimensions of the various rheostats, etc. The potentiometer should have a value of about 400 ohms while the rheostat may have a value of ten ohms. Some Fleming valves are built for a battery potential of four volts and others for twelve volts.

S. C., New Albany, Ind.:

We are unable to tell why the high voltage

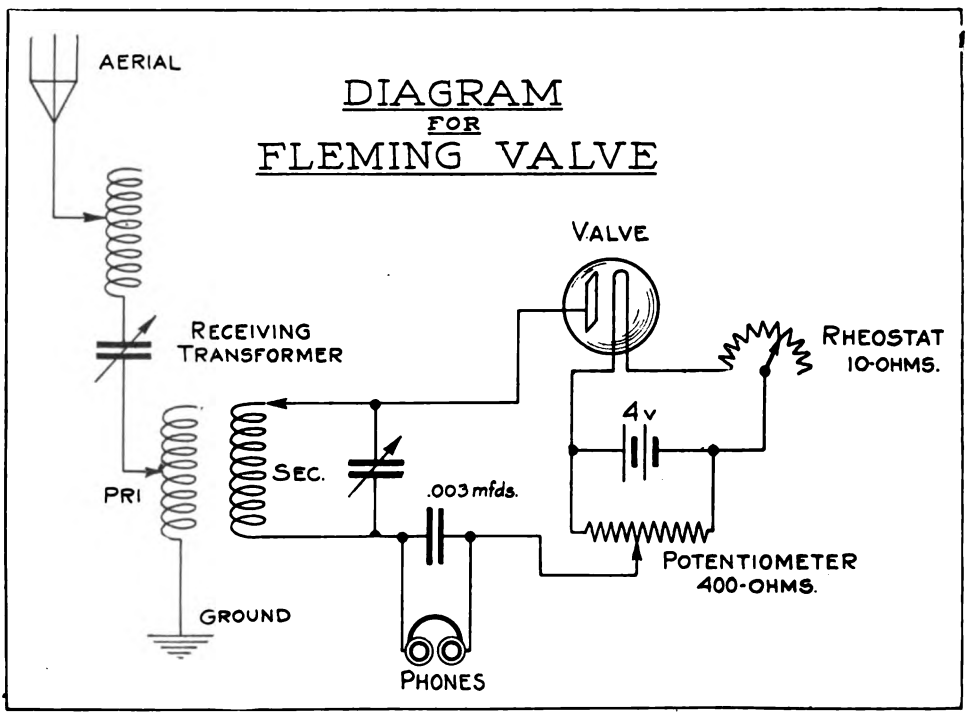


*Fig. 2*

disc about 8½ inches in diameter, with 10 points equally spaced around the periphery, to revolve at a speed of, say, 2,800 to 3,000 R.P.M. When attempts are made to secure an extremely high frequency note from a low frequency source of supply, the results for obvious reasons are generally not satisfactory. It is not advisable to employ more than 400 spark discharges per second with a non-synchronous gap; in fact the best results have been received in commercial practice by using about 240 sparks per second. We have observed no advantage in driving the gap at a speed greater than 3,000 R.P.M.

We should prefer a slow speed disc of fair diameter with a sufficient number of points, rather than a high speed disc with not so great a number of points.

battery in your vacuum valve detector set loses its strength so rapidly. Either the cells are inferior or there is leakage in some portion of the apparatus which is causing the trouble.

* * *

T. J. L., Boston, Mass., says that while talking with the owner of a receiving station recently, the latter remarked that with his set (which consists of a transformer, condenser, Ferron detector and a pair of 2,000 ohm head telephones), he is able to pick up messages without the use of an aerial, the earth wire only being employed; to be more explicit, he

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merely laid the apparatus on the table in his home. How was this accomplished? Could it be done with an ordinary tuning coil, condenser, crystal detector and head telephones?

Ans.—Such effects have been observed in many receiving stations, particularly when the transmitting station is located nearby. If the receiving station is fitted with an aerial—and even though the apparatus is disconnected from the aerial—a considerable portion of the energy picked up by the antenna system is re-radiated into the tuning coils of the receiving apparatus and, in consequence, considerable distance can be covered. It is also possible that this energy is re-radiated by telephone wires, gas pipes or water pipes located within the house.

We cannot determine the probable range of a receiving aerial placed underneath a roof as you describe. We suggest that you make the experiment and determine the range for yourself.

We have no information regarding the reported invention of a wireless receiving set which requires neither earth nor aerial and believe that the public has been misinformed.

Regarding aerials laid over the surface of the earth: Receiving work of this kind was performed by the engineers of the Marconi Company in the Sahara Desert, satisfactory results being obtained. The circuits employed and the actual dimensions of the aerial have not been published.

* * *

R. S., Davenport, Ia., inquires:

Ques.—(1) Where can I obtain a 1 to 1 auto transformer of 8,000 ohms to be used in connection with a vacuum valve amplifier circuit as described in the January, 1914, issue of THE WIRELESS AGE?

Ans.—(1) Communicate with the Manhattan Electric Supply Company, New York City.

Ques.—(2) Should the 1,800-ohm fixed resistance used in the perikon circuit be of German silver or graphite?

Ans.—(2) Either may be used.

Ques.—(3) What is the best combination of minerals to be used for the perikon?

Ans.—(3) Zincite and chalcopyrites.

* * *

L. J. K., Yonkers, New York:

Ques.—(1) I have two ½-inch Bosch automobile coils. Can I connect them so as to get a 1-inch spark and how many volts should I employ?

Ans.—(1) Connect the primary and the secondary windings in series. Put a shunt around one of the interrupters and allow the circuit to be broken by a single interrupter. Between twelve and sixteen volts of battery are required.

Ques.—(2) What would be the approximate sending range of an aerial, 70 feet in length and 30 feet in height, consisting of four wires and a lead-in 35 feet in length?

Ans.—(2) You should be able to cover a distance of from six to eight miles.

Ques.—(3) I have a 3-wire aerial, 130 feet in length and 52 feet in height, a 4,000 meter loose coupler, fixed condenser and two galena detectors; also a Brandes superior head set. Shall I be able to receive Glace Bay and Sayville, using these instruments and a ten-tap loading coil, 10 inches in length by 5 inches in diameter, wound with No. 28 enameled wire. I get the signals from NAA very loud at noon, at present, using two-thirds of my loose coupler primary winding.

Ans.—(3) In the first place, the station at Glace Bay uses damped oscillations, while the Sayville Station at present employs undamped oscillations exclusively. You would, therefore, require separate apparatus for the two stations. A receiving set suitable for both stations is described in the article in the series, "How to Conduct a Radio Club" in the July, 1915, issue of THE WIRELESS AGE. With the antenna described, used in connection with a loading coil and receiving tuner, you will hardly be able to adjust your apparatus to the wave-length of Glace Bay. It is impossible to hear Glace Bay inland in the United States except by the use of a supersensitive receiving set.

Ans.—(4) The Sayville station operates at a wave-length of about 9,000 meters and can be heard any evening after fifteen minutes after nine o'clock and also occasionally throughout the day.

Ques.—(5) Please tell me what size spark coil I can construct with a soft iron core 10 inches in length by 1½ inches in diameter; a a primary winding of two layers of No. 18 enameled wire, and 1¼ pounds of No. 36 S.S.C. wire. How should I wind the secondary and what size spark should I get out of this apparatus?

Ans.—(5) The various parts of this coil are ill-proportioned throughout for efficient results. For example: The core has sufficient dimensions for an 8-inch spark coil, while the primary winding is suited to a 1-inch coil. We may compromise in the following manner:

The iron core should be 5¾ inches in length by ½ inch in diameter, covered with two or three layers of empire cloth. Is is then covered with two layers of No. 18 wire. The secondary winding may consist of one pound of the No. 36 enameled wire split up into two sections, each of which will be about 1¾ inches in diameter and about 2¼ inches in width. The primary condenser for this coil should have approximately 900 square inches of tin-foil. It will then have a capacity of about 1 inch.

* * *

M. S. P., New York City, inquires:

Ques.—(1) What is the largest aerial of the inverted L type in length, height and number of wires that I can erect that will radiate the maximum amount of energy and at the same time conform with the 200-meter regulations? I am using an oscillation transformer with a ¼ k.w. high potential transformer.

Ans.—(1) This query has been answered many times in this department. In order that the emitted wave may be within the United States regulations of 200 meters, the dimen-

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sions of the antenna must be of such value as to permit a few turns of inductance at the secondary winding of the oscillation transformer to be connected in series. The antenna, therefore, should have a natural wavelength of about 160 meters. A 4-wire inverted L flat top aerial, wires spaced two feet apart, having a height of 40 feet and a length of 50 feet, will have a natural wave-length of about 162 meters. An antenna, 30 feet in height by 60 feet in length, will have the same value of wave-length.

* * *

P. E. G., Franklinton, La.:

Ans.—At night time, during the winter months, with the receiving apparatus you describe, you should be able to receive at a distance of 1,000 miles, provided your apparatus is connected up properly. Please observe the diagram of connections given on page 743 of the July, 1915, issue of THE WIRELESS AGE. Follow this method of conection closely and you will secure efficient results. It may be that your reciving dectector is not sensitive, or that your antenna is shielded so that the reception of energy is interfered with. You will, of course, receive increased strength of signals by use of the vacuum valve amplifier, as described in the Januarv, 1914, issue of THE WIRELESS AGE. We should have been able to reply more specifically if you had sent a diagram of connections of the receiving apparatus.

* * *

G. E. W., San Francisco, Cal.:

The apparatus described in your query will permit the reception of signals at wavelengths up to about 5,500 meters. The receiving range of this set should be about 150 miles in daylight and, say, 800 to 1,000 miles after dark. The diagram of connections accompanying your manuscript is correct, but better results will be obtained if you will connect the telephones around the fixed condenser of the local detector circuit.

Your query regarding the call letters of certain high power stations, is fully answered in "Queries Answered" in the August, 1915, number of THE WIRELESS AGE.

* * *

R. P. B., Meadville, Pa., inquires:

Ques.—(1) There is an electric arc light directly in front of our house and at night the buzzing from this light drowns out pracically all of the short wave stations. If you can suggest some method for getting rid of this trouble I should be greatly obliged.

Ans.—(1) You have a difficult problem on your hands. Refer to the article in the series, "How to Conduct a Radio Club," in the July, 1914, number of THE WIRELESS AGE, where a method is described for the reduction or possible elimination of arc light induction. In this system a second aerial is erected near the arc light circuit and inductivelv coupled through a coil to the primary winding of the receiving tuner, being so connected that the lines of force produced will be opposite to those of the standard aerial. By selecting proper values of coupling, the effects of arc light induction may be neutralized and the desired signals received with a slight decrease in intensity.

* * *

M. C. I., Needham, Mass.:

Ques.—(1) Is the best position for the fixed condenser in a receiving circuit across the head telephones, or in series with the detector and the secondary variable condenser?

Ans.—(1) The condenser is preferably connected across the head telephones, or also in series with one of the terminals of the secondary winding of the receiving transformer to the detector.

Ques.—(2) Is there any good method for cleaning perikon crystals?

Ans.—(2) They may be scrubbed with soap and water, cleaned with gasolene or with a solution of carbon bi-sulphite.

Ques.—(3) Will the currents in a wireless telegraph circuit leak through oak wood to such an extent that they will cause a noticeable loss in the efficiency of a receiving set?

Ans.—(3) Not if the wood is dry and is kept in a dry place. If it is exposed to moisture, a considerable decrease in strength of signals will result. We suggest that you soak the wood in boiling hot paraffine before using.

* * *

R. V. R., Arthur, Ill:

The design, construction and use of a variometer are told of in detail in the article in the series, "How to Conduct a Radio Club," which appeared in the March, 1915, issue of THE WIRELESS AGE.

The receiving apparatus described in your communicaiton, if used in conection with an antenna having a length of 325 feet, would allow the rectption of signals up to about 3,400 meters. For an answer to your question regarding a receiving transformer to give the maximum efficiency on 2,500 meters, you are referred to the reply to *C. H. S.'s* inquiry in the October, 1915, number of THE WIRELESS AGE.

We have no data regarding the Makean vacuum valve amplifier.

The variable condenser of a receiving set is preferably connected in shunt to the secondary winding.

* * *

E. G., Springfield, Ohio:

The main points of difference between damped and undamped oscillations are discussed on page 635 of the May, 1915, issue of THE WIRELESS AGE. This matter is fully covered in all text books on radiotelegraphy.

A six-wire aerial used for receiving purposes has little advantage over a four-wire aerial. Of course the six-wire aerial has a decreased value of high frequency resistance and affords a slight increase of capacity and a decrease in inductance.

Regarding your query concerning aerial wires: we advise the use of standard phosphor bronze wire. It is preferable to all types and is used altogether by comercial companies.

In answering your query regarding the charging of a Leyden jar by an induction coil, it can be stated that the actions are practicallv identical with that of the transformer, with

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the exception that the current in the secondary winding of an induction coil is very near unidirectional. If a high potential is applied to the coatings of a Leyden jar, an electrostatic charge is set up on the surface of the jar, and if a suitable spark gap is provided a discharge will take place when the potential of the jar has reached a sufficient value to jump the gap.

* * *

R. J., Eureka, Cal., inquires:

Ans.—(1) What is the difference between the DeForest vacuum valve detector and the Fleming valve?

Ans.—(1) The Fleming valve comprises a hot filament and a cold plate in vacua, while the DeForest valve has a hot filament, a cold plate and a nickel grid between the filament and the plate.

Your second query—the question regarding a diagram of connections for a telegraph line—is outside the scope of this department.

Ques.—(3) Does the size of the wire make much difference in the strength of signals? Are No. 28 on the primary and No. 32 on the secondary too small?

Ans.—(3) In the design of a receiving transformer certain princples must be considered. The dimensions you suggest are applicable and will give good results, particularly with the vacuum valve detector. If the wire on a receiving tuner is coarse the winding for a given valve of wave-length will have a large value of distributed capacity which may cause considerable energy losses. If, on the other hand, the wire is decreased in size the value of distributed capacity is also decreased and if the resistance of the wire is not detrimental, an increase in strength of signals will be obtained. Again, in the design of a winding for a receiving transformer to be used in connection with detectors requiring a great value of potential, the secondary winding, for obvious reasons, is preferably of fine wire.

Ques.—(4) Where can good galena crystals be purchased. I have tried several places, but could not get good pieces.

Ans.—(4) Communicate with Eimer & Amend, Third avenue, New York City.

Ques.—(5) Where is the best place to connect a variable condenser in an inductively-coupled receiving transformer?

Ans.—(5) It is preferably placed in shunt to the secondary winding.

* * *

C. S. W.:

Ans.—(1) The sensitiveness of telephone receivers can be tested in the following manner:

The telephones should be connected in the local circuit of a receiving set and inductively coupled to a wave-meter which is energized by a small battery and buzzer. The coupling between the receiving transformer and the wave-meter should be decreased until the signals are fairly audible. An ordinary telephone receiver should then be connected in the circuit and shunted by a potentiometer which is adjustable from, say, 2,000 ohms to zero. The sliding contact of the potentiometer (or a simple variable resistance) should be moved toward zero position until the signals disappear and the corresponding value of resistance is noted. These telephones should then be removed from the circuit and replaced by the second set and the same process repeated. If the signals disappear with the second telephone set at a point of lower resistance than with the first named set, the telephones can be considered as more sensitive in the ratio of the resistances. This statement, however, is only true when the two telephones have identical values of resistance. It will, however, afford an approximate calculation which will be quite sufficient for the purposes of amateurs.

Ans.—(2) A battery current flowing through a telephone will not impair its sensitiveness because the magnetic field produced by the current is not of sufficient value to destroy the existing field.

For a receiving tuner to have a range of wave-lengths ranging from 150 to 3,000 meters, we refer you to C. H. S.'s inquiry in the October, 1915 issue of THE WIRLESS AGE. For the mere reception of signals at wave-lengths of from 150 to 3,000 meters, the natural wave-length of the antenna system cannot be more than 200 meters. An aerial 40 feet in length by 70 feet in height, comprising four wires spaced 2 feet apart will have a natural wave-length of this value. It is preferable to erect two aerials, one having a natural wave-length of about 500 meters for reception of wave-lengths of 3,000 meters, and a second one having the smaller dimensions.

We have made no test on a spiral receiving aerial and consequently cannot give any information regarding its efficiency.

* * *

F. G., Pittsburgh, Pa., writes:

The radio inspector tells me that my aerial has a wave-length of 350 meters. Please tell me how many plates in a short wave condenser are required in order that the wave-length of this system may be reduced to 150 meters.

Ans.—(1) Your aerial is entirely too long for a reduction to a wave-length of 150 meters. It will be necessary to erect a new aerial having decreased dimensions. An aerial 40 feet in height by 55 feet in length, comprising four wires spaced two feet apart, will have a natural wave-length of about 160 meters.

* * *

P. M. W., Bradford, Pa.:

We cannot give you the approximate wave-length to which your receiving apparatus will be adjustable because you have not furnished us with data regarding the dimensions of the coils. The mere fact that you have wound up 500 turns of wire gives us no basis for calculation. For the vacuum valve detector No. 36 wire in the secondary is entirely feasible, but not with the crystalline detector. The primary winding of your receiving transformer may be of No. 28 wire, but we should prefer No. 24 or No. 26.

You have not furnished us with the com-

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plete dimensions concerning your antenna and consequently we cannot tell its wave-length.

Regarding that part of your communication concerning the 1 to 1 transformer described in the January, 1914, issue of THE WIRELESS AGE: It is not necessary to construct a winding especially for this. The secondary winding of a 2 or 3 inch spark coil or even of a ¼ or ½ k.w. power transformer will give efficient results. There is no advantage in the use of duplex loading coils and duplex secondaries and we cannot understand why you take the trouble to construct aparatus of this kind. Duplex loading coils were primarily intended for boosting the wave-lengths of a receiving transformer whose values of inductance were not sufficient for the range of wave-length desired. But when an amateur constructs a new receiving apparatus, there is no advantage in using this method of construction or design.

The July,1915, issue of THE WIRELESS AGE contains a diagram of connections for supersensitive receiving sets which will be preferable to the diagram of connections indicated in your drawing. Note also the diagram of connections appearing on Page 743 of the July issue.

* * *

R. R., Norristown, Pa., inquires:

Ques.—(1) What are the inductance and capacity of a coil 3 inches in diameter, 12 inches in length, wound full, of No. 30 S. D. C. copper wire? How can they be calculated?

Ans.—(1) The inductance of this coil is 9,413 microhenries. It can be calculated as per article appearing on page 843 of the August, 1915, issue of THE WIRELESS AGE. The distributed capacity of this coil can be computed from the following formula:

$$C = \frac{\lambda^2}{4\pi^2 v^2}\left(\frac{1}{L} - \frac{1}{L_1}\right)$$

$\lambda$ = wave-length of coil.

v = velocity of propagation—electro-magnetic waves in ether (300,000,000 per second.

L = true inductance of the coil.

$L_1$ = effective inductance of the coil.

For further information see proceedings of the Institute of Radio Enginers for April, 1913.

Ques.—(2) Certain receiving sets have a micrometer spark gap which is supposed to prevent the acumulation of static discharges. Is this device successful and what should be the size of the gap

Ans.—(2) The gap is not intended to eliminate the ordinary discharge such as those which create the interfering sounds in the receiving telephones. The miniature gaps are only intended to discharge extraordinary potentials which might accumulate in case of lightning or should a wire of the receiving apparatus drop across the transmitting apparatus during transmision. Generally this gap is about 1/150 of an inch in length and consists of about 1/32 of an inch.

Ans.—(3) The micrometer gap does not cause any loss of received energy.

Ans.—(4) Galena crystals can be purchased from Eimer & Amend, Third avenue, New York City.

The following is an interpretation of the call letters given in your last query:

NNC—U. S. S. Jupiter.

KNA—Not listed.

KAN—Angaur Paloas Islands (German land station).

MMP—Salsette (The Peninsula & Oriental Steam Navigation Co.).

* * *

E. C. R., Washington, D. C.:

We are unable to account for the peculiar phenomenon which you experienced—that increased antenna radiation is secured when discharge takes places across the gap of the protective device fitted to the primary winding of your high potential transformer. It is possible that you have an imperfect earth connection and consequently this gap in some manner becomes a portion of the open circuit oscillator, but beyond this we are unable to explain the phenomenon. After a careful inspection of the local conditions, we believe we could solve your problem, but with the information at hand, we cannot reply more specifically.

* * *

C. N. W., Bradford, Pa.:

The winding for the 1 to 1 auto transformer described in the January, 1914, issue of THE WIRELESS AGE, consists simply of a number of layers of silk covered wire wound backward and forward in the ordinary manner. We do not understand why there has been so much misunderstanding in the amateur field concerning the winding of this transformer. It is not a task of great difficulty to wind four pounds of wire on an iron core in the ordinary manner. It is also apparent that no particular insulation is required between the lavers of this winding on account of the low potentials employed. The secondary winding of the spark coil or high potential power transformer may be substituted for this winding.

It is impossible for us to calculate the capacity of a condenser for a given transformer unless we know the secondary voltage. In this case we are not familiar with the voltage of the transformer described and consequently cannot answer more specifically.

The rights for the commercial use of wireless telegraph aparatus are fully covered by the patents of the Marconi Company; it would be a violation or infringement of these patents, therefore, to set up a commercial transmitting equipment.

The free end of the aerial should extend in the opposite direction from which it is desired to transmit. It makes no difference whether the wires are open or closed at the free end except in a case where they are of unequal length. Then it might be of advantage to join them together in order to neutralize any differences of potential.

* * *

C. R. S., Fairmont, W. Va.:

We are unable to offer any helpful suggestions regarding an indoor receiving aerial because of the conditions stated in your com-

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munication. While signals have actually been received on a brass bed, great distances have not been covered. Signals can be received for a considerable distance on the ordinary telephone line, but as stated in your communication, loud buzzing sounds are produced. The majority of telephone lines in the open country are subject to induction from nearby power and trolley lines, and consequently it is very difficult to eliminate this disturbance. When employing a telephone line for a receiving aerial you should connect a variable condenser in series with the earth lead in order that the working of the telephone line may not be interfered with.

A reply to your question concerning the circuits of a buzzer test will be found in the "Queries Answered" department of THE WIRELESS AGE for September, 1915.

* * *

M. J. S., San Francisco, Cal., inquires:

Ques.—(1) Some time ago I constructed a single wire aerial of standard bronze wire which was suspended from a pole of about 60 or seventy feet above the earth on the summit of a hill. The base of the pole was about 150 feet higher than the foot of the hill where my station is located. I then extended the aerial to a 10-foot pole on the top of a near-by factory engine house, which is about 80 feet above the earth, the distance between these two points being about 459 or 500 feet. The aerial was then continued to a pole on my house, about 30 feet from the ground, increasing the length 80 or 90 feet more. The entire aerial, as you will see, had a length of 600 feet. The wire extends from the engine house to the top of the hill, approximately due north and south; another stretch of about 90 feet runs northeast and southwest.

I have kept a record of some of the distances covered in receiving work with this aerial. I have copied NPB (Sitka, Alaska); KHK (Honolulu, T. H.); WWL (s.s. San Jose), San Blas, Mexicon; NWG (U. S. S. West Virginia) at Mazatlan, Mexico, and numerous other stations along the Mexican and Canadian coasts. NPE (North Head, Wash.); NPW (Eureka) and NPL (San Diego) can be copied at noon regularly. I have copied WKL (s.s. Mexican), 700 miles out from Honolulu; WKD (s.s. Dakotan), 962 miles west of San Pedro, Cal., and the s.s. Washingtonian, 354 miles south of San Pedro, Cal. This was accomplished without difficulty on a typewriter.

I was compelled three months later, because of certain circumstances to take this aerial down. This time I erected another aerial, extending the same wire from the top of a tall brick chimney at the factory, about 150 feet above the earth, to the same pole on the engine house and thence to my station. Now the long span of this aerial, which was about the same length as the other aerial, ran east and west instead of north and south, like the first described aerial. I expected better results from the latter aerial, as at one end the height was about twice that of the original aerial, but when listening in one night with the same set of receiving aparatus, I was greatly disappointed. On the first described aerial I could secure a spark from my galena detector when KPH (San Francisco) was sending. On the second aerial I could not repeat this operation and the signals were considerably weaker. Nor could I copy on the typewriter the stations I named previously, and my distance work was reduced to a great extent; neither could I copy NPE, NPW and NPL in the daytime. The thought may occur to you that something is wrong with my set, but I wish to state that I have looked it over in detail and the aparatus is in as good condition as it was when connected with the first described aerial.

Can you throw any light on the subject?

Ans.—(1) We lack complete data regarding the conditions about your station, the general nature of the country, and the shape and type of aerials employed at the various transmitting stations. Therefore we are somewhat handicapped in answering. In the first place, the natural wave-length of your aerial is in the neighborhood of 1,100 meters and consequently we believe that you require a variable condenser in series with the antenna system to tune your aparatus to the wave-length of ship stations. This aerial, however, is entirely suitable for the wave-length of many of the land stations named.

The first described aerial undoubtedly was so disposed as to receive the maximum cutting of the lines of force from San Francisco's aerial, but when changed to an easterly and westerly direction it was outside the electrostatic and electromagnetic fields of San Francisco's aerial. As a result a decrease in strength of signals was obtained. Just why this should be the case with all stations we are unable to state, but it may be that the second described aerial has a natural period of such value that complete resonance cannot be established between your antenna and the wave-length of certain distant transmitting stations. Perhaps the conditions on the Pacific coast are such (taking into consideration the local mountain ranges) that an aerial having a general north and south direction is more suitable for the reception of wireless signals on the coast than if placed in an easterly and westerly direction.

We advise you to allow your aerial to remain in the present position and, if possible, in some manner reduce its length. For example: About 100 feet from the extreme end break the continuity of the aerial circuit by a hard rubber insulator and see if this alteration does not allow more exact conditions of resonance.

You understand, of course, that the radiation from a wireless telegraph aerial is considerably distorted in transit and in consequence, when receiving from any particular station an aerial having a particular shape both as regards height and length, may give better results than one of other construction. It is also a fact that a single wire aerial exhibits more directional properties than one of multiple construction. This is particularly the case

when the major portion of the aerial is in the form of a flat top. If we had known in which direction the free end of your aerial points, we might have given additional advice.

* * *

R. W., Plainfield, N. J., inquires:

Ques.—(1) Please furnish me with the address of some supply house selling micanite tubing. I need the latter to construct a six-inch coil as described in the April, 1915, issue of THE WIRELESS AGE.

Ans.—(1) Communicate with the Mica Insulator Company, No. 68 Church street, New York City. Quotations will be given upon request.

* * *

D. B. R., Wellsboro, Pa., inquires:

Ques.—(1) Please give me complete data and information for the construction of a ½ k. w. transformer. What aditional instruments are required in order that this set may be used to transmit a distance of forty miles.

Ans.—(1) Complete data for the construction of a closed core, ½ k.w. transformer appeared in the "From and For Those Who Help Themselves" department in the August, 1915, issut of THE WIRELESS AGE. At a wave-length of 200 meters it is doubtful whether this transformer will transmit forty miles. It may be possible if the receiving station is fitted with a sensitive vacuum valve detector, but not otherwise. We advise you to communicate with the Cost and Sales Department of the Marconi Wireless Telegraph Company of America, 233 Broadway, New York City, and, if possible, purchase a complete second-hand transmitting set of the type now offered for sale. The additional aparatus required is as follows: a high potential condenser, an inductively coupled oscillation transformer, a rotary or plain spark gap, an aerial with necessary spreaders, insulators, etc.

Ques.—(2) Should an electrolytic interupter be used in the primary circuit of a ½ k. w. transformer to secure the proper current from a 110 volt, 60 cycle, A. C. source of supply? Where can I purchase such an interrupter?

Ans.—(2) If you have an alternating current source of supply, an interrupter is unnecessary, provided the transformer is of the proper design. An induction coil is often operated from an alternating current source of supply by an electrolytic interrupter because the windings of an induction coil are unfitted for direct connection to an alternating current source of supply.

* * *

W. R. H., Vonore, Tenn.:

The aerial described in your first query has a natural wave-length of 325 meters and if used in conection with supersensitive receiving aparatus of the vacuum valve type, will allow the reception of signals from stations having wave-lengths up to about 5,000 meters. The nearest Marconi high-power station in operation is located at Glace Bay, Nova Scotia, which operates on a wave-length of 8,000 meters. The apparatus you describe cannot be adjusted to this wave-length and in consequence, you will have to resort to the reception of signals from other stations. The station located at Tuckerton, N. J., is in daily operation and if you fit your station with apparatus for the reception of undamped oscillations, you should be able to hear its signals.

Ans.—(4) Unless the receiving apparatus is properly designed throughout, there is, as you state, considerable loss of efficiency when a small aerial is loaded to a great wave-length.

For information concerning Marconi apparatus on sale, communicate with the Cost and Sales Department of the Marconi Wireless Telegraph Company of America, 233 Broadway, New York City.

* * *

J. K. E., Jersey City, N. J., writes:

Ques.—(1) Please tell me the approximate wave-length of an aerial consisting of four wires 83 feet in length, with a lead-in of 34 feet; it is 40 feet in height at one end and 35 feet at the other. The lead-in wires are spaced about 15 feet from the end.

Ans.—(1) The natural wave-length of this aerial is about 225 meters.

Ques.—(2) Can a condenser for transmitting purposes in connection with a 3-inch or 4-inch spark coil be made from sheets of tinfoil 2¾ by 8 inches, with paraffine paper intervening?

Ans.—(2) No. Paraffine paper is positively unsuitable for this work. It has insufficient dielectric strength to withstand the voltage. You should use glass plates having a thickness of about ⅛ of an inch for this condenser.

* * *

M. B. W., Lima, Ohio:

No advantage would be derived in coupling two 200-meter closed oscillatory circuits to one aerial. If a non-synchronous type of spark discharger were employed, it would be found difficult to keep them in exact synchrony. If the dischargers were out of phase you would then have the phenomenon of overlapping wave trains and by the addition of a sufficient number of separate oscillatory circuits the radiated energy would begin to assume the nature of undamped oscillation. If several 200-meter sets of low frequency were coupled to a single aerial and were so adjusted that the spark dischargers would follow each other at regular intervals, you would secure no more advantage than might be obtained by a single set of a higher spark frequency.

Ques.—(2) With my present condenser it requires 2½ turns of inductance in the closed circuit to bring it in resonance with the antenna. In order to secure the maximum radiation the rotary spark gap must be run at a slower speed than I would like—about 2,500 R. P. M. This gap has six lugs and normally runs about 5,000 R. P. M. Is it preferable to decrease the capacity and increase the inductance, or simply run the gap at normal speeds. With the gap revolving at

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5,000 R. P. M. and the same capacity and inductance as mentioned, my night range in the winter time is about 800 miles. Reducing the speed of the rotary increases the antenna current about 30 per cent., but at this time of the year it is impossible to determine the effect.

Ans.—(2) The constants of your circuits are such that when the speed of the rotary disc is decreased the amplitude of the oscillations per wave train is increased, as is also the current in the antenna circuit, because the charging periods of the condenser are longer. In a problem like this there are two conditions working against each other and in consequence we must arrive at a happy medium. An increase of spark frequency in your set may result in increased strength of signals on account of the fact that the telephones are more responsive to a certain higher frequency than that afforded by the ordinary 60-cycle current. It is also possible to go in excess of this frequency and in consequence a decrease in signals at the distant receiving station is experienced. When your gap revolves at a speed of 5,000 R. P. M. you have a spark frequency of approximately 480 equivalent to a 240-cycle synchronous spark set. Whether or not it would be desirable to allow the gap to revolve at this speed and decrease the condenser capacity correspondingly depends very largely upon the constants of the remaining elements of your circuit and the wave-lengths at which the set is worked. Experience in similar cases has proven that it is preferable to reduce the speed of the rotary, allowing the condenser capacity to remain at its present value. To sum up the foregoing: Increased current in the antenna circuit is bound to result in increased range, provided the spark frequency is not lowered to such a value that the diaphragms of the head telephones cease to respond at their maximum amplitude.

Ques.—(3) There seems to be a definite relation between the transformer voltage, the condenser capacity, the speed of the rotary spark gap and the distance between the points on the disc. Reducing the number of points on the gap to two and revolving the latter at 6,000 R. P. M. resulted in a punctured condenser and all sorts of additional troubles, even when a ¼-inch plate glass was used as the dielectric, while with a 6-point gap, rotating as low as 1,200 R. P. M. a 3/16-inch plate glass gave no trouble whatsoever. Can you tell how to arrive at the happy medium?

Ans.—(3) For efficiency there undoubtedly is a definite relation between the voltage frequency and condenser capacity, as you state, and furthermore, two revolving electrodes, at a speed of 6,000 R. P. M., are not the equivalent of six electrodes at a speed of 5,000 R. P. M. The same statement aplies to the six-point disc, at 1,200 R. P. M. Unless you have made accurate measurement of the actual speed of these discs we believe there has been some error in your calculation. When a number of electrodes are employed on the disc, the time interval between the spark discharges is not so great and consequently the condensers are not under the strain to which they are otherwise subjected; that is to say, in the case of two revolving electrodes, the potential of the condenser rises to a higher value than would be possible with a number of electrodes. A number of experiments with various types of wireless equipment operated on a primary frequency of sixty cycles would seem to indicate, taking into account the low frequency supply, that no advantage is derived in attempting to produce more than 400 sparks per second. You must take into consideration the fact that with a sixy-cycle source of supply, there are 120 periods of zero voltage in the transformer and should the stationary and movable electrodes of a rotary gap come together at this particular instant, no spark or discharge will result; the condenser is also subjected to increased strain. Therefore, the spark frequency of a non-synchronous set cannot be uniform. It is desirable in rotary spark gaps of all kinds that the distance between the stationary and movable electrodes be at a minimum; if possible, not more than 1/32 of an inch.

A little consideration of the problem will reveal to you that inasmuch as the non-synchronous gap dischargers bear no relation to the A. .C. charging potential, a revolving disc with but two electrodes, is more apt to discharge (that is to say, the revolving and stationary electrodes are more apt to come opposite) at points of zero voltage than in the case of a slower speed disc fitted with a greater number of electrodes.

The folowing formula indicates the relation between capacity, transformer, voltage and spark frequency:

$$C = \frac{W}{V^2 N}$$

Where C = condenser capacity in mfds.
W = watts of energy.
V = kilovolts (at (secondary of transformer).
N = cycle frequency of the charging potential.

Divide the spark frequency of a set by two to obtain N.

* * *

*Readers who submit questions to this department will greatly facilitate the work of its editor by not requesting immediate answers. Many questions received do not appear in these columns because they are not of general interest. Every effort is made to give prompt service, but as we usually have on hand for each issue more than 5,000 queries, it is obvious that all cannot receive immediate attention.*

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## MARCONI SET AT BANQUET

Members of the International Gas Congress, the American Gas Institute and the Pacific Coast Association saw a Marconi wireless set in operation in a banquet room of the Inside Inn on the grounds of the Panama-Pacific Exposition where they attended a dinner on the evening of September 30. Marconigrams were exchanged between Lucius E. Pinkham, Governor of Hawaii, and Dr. Alexander E. Humphreys, president of the International Gas Congress.

A short aerial was installed on the roof of the Inn by the Marconi Wireless Telegraph Company of America and extended to the banquet table where it was connected with a ten-inch induction coil and a tuner of the latest Marconi type. An operator in full uniform was in charge of the apparatus.

While H. S. Strange, manager of the Honolulu Gas Company, and also secretary of the Honolulu Ad Club, was responding to a toast he was informed that Honolulu wished to transmit a wireless message. Dr. Humphreys, J. A. Britton, vice-president and general manager of the Pacific Gas and Electric Company; W. R. Castle, president of the Honolulu Gas Company, and others took positions where they could better witness the operation of the set. The following Marconigram was received:

Dr. Alex. E. Humphreys, president International Gas Congress, San Francisco:

Hawaii sends greetings and aloha to International Gas Congress.

LUCIUS E. PINKHAM,
Governor of Hawaii.

The Marconigram was received at the Marshall station and transmitted to the Hillcrest station and then to the banquet room. The following Marconigram was sent in reply:

Governor LUCIUS E. PINKHAM,
Honolulu:

The Gas Congress welcomes your gracious message. By the same destroyer of distance we give the best wishes of the gas men and the people of San Francisco assembled.

ALEXANDER E. HUMPHREYS.

This message was transmitted to the Hillcrest station, thence to Bolinas and Honolulu, so that the banquet table was in actual wireless communication with the Hawaiian city. After Governor Pinkham's message had been read, Mr. Strange talked briefly regarding the Marconi high power stations and referred to the progress of the Marconi globe-encircling scheme. The members of the committee in charge of the banquet expressed their thanks to the Marconi Company for the facilities which had been placed at their disposal.

## THE VALUE OF WIRELESS TO VESSELS IN DISTRESS

During the fiscal year 1915 the radio inspectors of the Bureau of Navigation reported 26 cases of vessels leaving our ports which met with accident or disaster, requiring the use of wireless to summon assistance. Four of these were from fire; 12 were from running ashore, stranding, or getting into an ice jam; 3 were from the breakage of machinery; 4 resulted from collisions; 1 from shifting of cargo, 1 vessel was storm-battered and waterlogged; and 1 was torpedoed. Excepting in the case of the Lusitania, which was torpedoed, the assistance thus rendered resulted in but two lives being lost. Since the close of the fiscal year the following disasters have occurred:

On September 13, 1915, the Fabre Line steamship Sant' Anna, bound from New York to Naples with 1,700 Italian reservists and crew aboard, caught fire in mid-ocean and all persons on board were saved. The S O S call brought the steamship Ancona to the assistance of the disabled vessel and 600 persons were taken off. The Sant' Anna then proceeded to port, convoyed by the Ancona, and the 1,700 passengers and crew were saved.

Six days after the Sant' Anna disaster, the Greek liner Athinai, bound from New York to Piraeus, caught fire in mid-ocean and was abandoned by the passengers and crew, numbering 470. The call for assistance was answered by the steamships Tuscania and Roumanian Prince; 341 persons were taken on board the Tuscania, the remaining 129 being taken off by the Roumanian Prince. The vessel was entirely destroyed.

The use of wireless apparatus on vessels carrying passengers or with 50 or more crew, is now accepted as essential to the safety of those on board.

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# THE WIRELESS AGE

Owing to the fact that certain statements and expressions of opinion from correspondents and others appearing in these columns from time to time may be found to be the subject of controversy in scientific circles and in the courts, either now or in the future, and to sometimes involve questions of priority of invention and the comparative merits of apparatus employed in wireless signaling, the owners and publishers of this magazine positively and emphatically disclaim any privity or responsibility for any statements of opinion or partisan expressions if such should at any time appear herein.

DECEMBER, 1915

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# War Incidents

## The Sinking of the Ancona. Directing British Gun Fire from an Aeroplane. Rescuing the Anglia's People

IT is the exception to the rule when an event of the European war occurs in which wireless and wireless men do not figure. Sometimes they are used to defeat the plans of the enemy; on other occasions they are employed to save human lives. And the art is invariably called into play to good purpose. This was the case when the Italian liner Ancona was sunk in the Mediterranean on November 7 by an Austrian submarine. Reports on the loss of the ship say that the Marconi operator on the former vessel sent out a distress signal when the attack was made and consequently a rescue ship arrived on the scene in time to save the lives of a large number of persons, among whom is said to have been one American. The loss of life is estimated at more than 200.

The Ancona left Messina at eight o'clock in the morning on November 6, according to a newspaper report. About half past ten o'clock on the morning of November 7 she picked up a wireless distress signal from the steamship France, reading: "S O S. We are being shelled."

The message ended abruptly without the position of the France being given, so that it was impossible for the Ancona to go to her aid. The Ancona continued on her route an hour afterwards, the sea being calm and the weather misty.

Without any sort of a warning the report of a gun was heard and shells simultaneously struck the Ancona forward, causing considerable damage. The wireless operator immediately sent out a distress signal with the name of the ship and her position.

The submarine approached nearer the Ancona, keeping up a continuous fire. First the wireless telegraph apparatus was demolished and then the lifeboats were shot to pieces. Fifty shots at least were fired until the Ancona stopped.

The commander of the submarine announced that he would allow ten minutes for all to quit the ship. The unsmashed boats at once were lowered, and after the wounded had been placed in them the passengers and crew followed. This was going on for half an hour when the submarine fired a torpedo which struck the Ancona on the bow. The ship sank gradually and finally disappeared beneath the waves.

Toward six o'clock in the evening the mine layer Pluton, which had picked up the Ancona's distress message, arrived on the scene. Most of the survivors thus were rescued close to the place where the steamer sank.

Additional details regarding the attempts to rescue those on the Ancona were obtained when the new Italian steamship Giuseppe Verdi reached New York on November 20 on her first voyage.

The Verdi heard the Ancona's wireless appeal for aid, flashed it on to shore stations, and then rushed at full speed to the Ancona's assistance. The Verdi steamed close to the spot where the Ancona went down, but her lookouts saw nothing.

Luigi Moroni, Marconi operator on the Verdi, said, according to a newspaper report:

"We were about 200 miles out from Palermo, watching for submarines which we had been told were nearby. At 9.20 I got a signal."

"'S O S France submarine,' was the message. Then 'Help.' This was followed by the France's position, and there was nothing more.

"We exchanged several messages with the relay ships concerning the France

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and submarines and while we were talking the Ancona's wireless broke in. It was 10.30.

"'S O S, S O S, Ancona,' we got. The Ancona gave her position. I sent this message to the shore stations as soon as I got it and within a few moments they sent back the answer: 'Go to the Ancona.'

"Captain Zannoni swung his ship right about and gave orders for full speed. The stewards quickly loaded the lifeboats with emergency supplies and swung them out on their davits.

"The passengers, told of the danger, were assigned to the boats, every man, woman and child being given a number. It was ninety-four miles to the Ancona and we made it at top speed.

"We tried to find some trace of the Ancona or her boats with glasses, but failed. Then we steamed away."

The officers of the Italian liner Duca Degli Abruzzi, which arrived in New York on November 17 from Genoa, said they left Naples two days ahead of the Ancona, and did not see any submarines. On the afternoon of November 5 the operator heard the S O S call for help, but could not get the name of the vessel nor her position. Next morning the liner passed a quantity of wreckage and a smashed lifeboat on which were letters indicating that it had belonged to a British freighter.

On November 7 the wireless operator picked up a message telling of the sinking of the Ancona.

When the German ship Konigsberg was attacked and destroyed by the British forces wireless in aeroplanes was used to direct the fire of the English. Chief Paymaster Charles Spedding of the Laconia, has written as follows regarding the manner in which the occupants of the British aeroplanes conducted themselves:

"During the second day of action an incident occurred which calls forth one's admiration of the pluck and presence of mind of Flight-Commander Cull and Wireless Expert Arnold, who were in the aeroplane that the Germans brought down. When it was seen that there was something wrong with the plane, the spotting corrections still continued, and the last message read as follows: 'Carry on, you are hitting her every time forward. We have been hit. Coming down on water. Send a boat.'

"A few seconds later the aeroplane (a land machine) crashed into the water, throwing Arnold out. Cull extricated himself with great difficulty under water a minute and a half after she struck. He had a very narrow escape indeed. Had these two officers not put the guns on to the Konigsberg in time a different ending of the whole action might have resulted."

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The British hospital ship Anglia struck a mine in the English Channel on November 17 and sank. Before she went to the bottom, however, wireless calls for aid were sent and a patrol vessel arrived in time to save about 300 persons.

## BEARS ATTACK POLAR EXPEDITION

A thrilling story of a fight with polar bears on drifting ice at the mouth of the Hudson Bay has been brought to Ottawa by a government expedition which has been erecting wireless stations in the far North, says an Ottawa, Ont., dispatch.

A. T. Fleming, a wireless expert, who headed the expedition, reports that while the party of six were endeavoring to locate a site for a wireless station at the entrance of Hudson Bay, they found themselves adrift on a huge floe of ice in a blinding snowstorm.

The following day they were without food and on the approach of night discovered that they were being surrounded by two dozen polar bears. The men took refuge on the top of a giant berg, while the bears gathered and laid seige. During the night the bears made an effort to reach the men, when one of them was killed by a well-directed shot.

In the morning the unwelcome visitors beat a retreat, and the men, half-starved and badly frostbitten, succeeded in reaching camp.

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## FIRST NAVAL ORDER BY WIRELESS TELEPHONE

Secretary of the Navy Daniels demonstrated to the naval forces of the nation the value of the wireless telephone on November 6 when he issued what has been described as the first navy order ever given by wireless telephone.

The Secretary's order was as follows: "Report as soon as practicable after arrival of the New York how soon the repairs can be completed." Admiral Usher received the message by wireless, replying by wire.

Secretary Daniels was sitting at his desk in the Navy Department in Washington, and personally dictated the order into the mouthpiece of a telephone transmitter. The message traveled over a land telephone wire to the main telephone office in Washington, whence it passed over a telephone wire to the naval radio station at Arlington.

Automatically the message was transferred from the telephone wire at Arlington to the antenna of the radio station and sent through the air to New York City. The message was picked up by the antenna of a wireless station in New York, where it was automatically picked up by land telephone wires, and transmitted by land wires to the office of Rear Admiral Usher in the Brooklyn Navy Yard.

Admiral Usher had his ear at the other end of the receiver and personally received the order. Admiral Usher's office was connected with Secretary Daniels's office by a long-distance telephone wire. By means of this direct land wire connection the commandant, talking to Secretary Daniels, acknowledged the receipt of the order.

"Later I expect to have the pleasure of talking with officers of the fleet at sea by wireless telephone," said Secretary Daniels. "Captain Bullard informs me that the special receiving apparatus will be installed for experimental use on some of the battleships, and that within two months I will actually be able to talk by wireless telephone to Admiral Fletcher, Commander-in-Chief of the Atlantic Fleet, while he is out in the Atlantic Ocean."

The experiment was begun at four o'clock and continued until five o'clock. During that period the Arlington station was temporarily placed out of commission for naval business and was used only in transmitting the radio telephonic message. More than fifty persons witnessed and took part in the experiment, all of the Naval Bureau chiefs being present. Mrs. Daniels, wife of the Secretary of the Navy, was an interested spectator.

The following is part of the conversation between Secretary Daniels and Admiral Usher:

Daniels—Hello.

Usher—How do you do, Mr. Secretary?

D.—Very well, admiral; how are you?

U.—Very well, thank you.

D.—You are looking well. Can you hear me distinctly?

U.—Yes, very plainly.

D.—Your voice sounds very distinct. I want to give you an order over this wire; will you have a stenographer take it down? It is an official message. (Then followed the message.)

U.—Yes, sir. Is there anything more you wish to say?

D.—How long will it take before we can get the California off the ways?

U.—We hope to get that monster off in about thirteen or fourteen months.

D.—Well, you will want another ship in a year, won't you?

U.—Yes, we will be glad to have one in about a year; we would like it a little earlier. We could prepare it much ahead.

D.—Admiral, you have my word, I will try to do that. By the way, admiral, here's a man who has an invention so that you can see over the 'phone. I can almost see you now, I hear you so plainly.

U.—I can hear you so distinctly I almost imagine I see you.

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## WAR PREPAREDNESS AMONG MARCONI OPERATORS

Being a firm believer in the axiom, "Preparedness in time of peace is insurance against war," the Marconi Wireless Telegraph Company of America has welcomed the suggestion made by Captain William H. G. Bullard, superintendent of the Naval Radio Service of the United States Government, as set forth in recent correspondence between the Navy Department and Edward J. Nally, vice-president and general manager of the Marconi Company.

In his letter Captain Bullard first called attention to the provisions of the Radio Act of 1912 giving the President the power in time of war or public peril to close any wireless station for radio communication, reciting that in such circumstances the United States Navy would require a number of competent operators to man the radio apparatus of ships now in reserve and of merchant vessels which would be taken over by the Navy for auxiliaries. He also called attention to the fact that an increased force of operators on board ships in commission and at shore stations, would be required.

With this emergency in view, Captain Bullard asked the co-operation of the Marconi Company in laying before the operators employed by that company a letter from which the following is an excerpt:

"The necessity of having a list of experienced men who would be available for the above purposes is very evident, and it is desired to obtain the names of such men in times of peace, and to revise the list from time to time as required, so that the Navy would not suffer from lack of operators or delay in training them, when the necessity arises.

"A form is enclosed herewith which, after making the entries as shown, should be mailed to the Superintendent of Radio Service, if you will signify your intention to serve in the Navy as a radio operator.

"This will in no way interfere with your occupation in time of peace, and can be withdrawn at any time, should you so desire.

"The Navy will offer an opportunity to operators to continue in their chosen profession and at the same time give them an opportunity of serving their country in its hour of need. This latter, it is believed, should be a determining factor in assisting you to decide to enter the Naval service at that time.

"The enrollment of your name among those who signify their intention to serve the country when required for the national defense, will be of great assistance in the efforts the Navy is making to carry out its policy. 'In time of peace, prepare for war,' and in this policy, you, as well as every American citizen, should be deeply interested. In the particularly important branch, the Naval radio service, you will not only show your interest, but will aid in making it effective, by a declaration of your intentions to offer your services."

The Marconi Company accepted this excellent suggestion and in his reply to Captain Bullard Mr. Nally, on behalf of the Marconi Company said:

"We shall be very glad, indeed, whenever you are ready, to do what we can to co-operate in the matter of the employment by the Government of radio operators of our company at such times as public exigencies might demand.'

A copy of Captain Bullard's letter requesting the return of the completed form referred to. was immediately placed in the hands of every operator in the Marconi service. The form covered the following points: Preference for ship or shore duty; number, date and class of license held; experience in wireless and wire telegraphy, and qualifications for sending and receiving.

Thus the Marconi Wireless Telegraph Company of America forges another link in the chain of national defense, the importance of which has been demonstrated in the European cataclysm and the many uses to which wireless has been put in time of public peril.

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## DECEMBER 12~1901

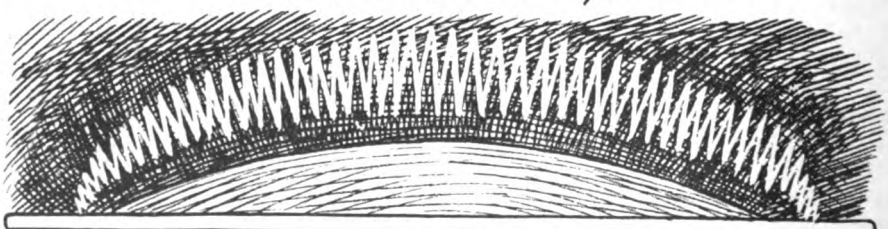
Day long, within the room,
Marconi waited
The calling Cornish key.

Without, the wild north storm
swept, unabated,
Across the northern sea;

And, like some lost gull by the winds belated,
The kite swayed high and free.

## DECEMBER 12~1915

To-day the great Pacific
Crossroads shiver
Beneath the white-hot pace!
Of speeding speech—a vast and vibrant quiver
In silent, sentient space --



And, sea to sea, there leaps the lightning sliver!
He leashed to time and place.

K·D·M· SIMONS Jr.

BISHELL.

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# Aboard the Seguranca in War Times

## A Chronicle of the Second Cruise of the Vessel Through the Danger Zone

**By J. K. Noble**

THE steamship Seguranca was introduced to the readers of THE WIRELESS AGE in the July issue of the magazine by S. Hopkins, who told of his observations made while he was wireless operator on the vessel during a voyage from New York to Rotterdam, the cruise including the war zone and mine fields. It was my fortune to be wireless operator on the Seguranca on another voyage to Europe. What happened and what I saw on the cruise I have set down in the following narrative.

*Two "huskies" steering the Seguranca with emergency gear when the cable of the mechanism usually employed parted*

We left New York on May 30 for Pensacola, Fla., planning to ship naval stores and lumber from the latter port to London. The first unusual incident of the voyage occurred a short time after he had passed Sandy Hook and were well on our way down the coast. A large hawk circled around the Seguranca and, finally becoming exhausted, perched on top of our forward mast. Apparently he was hungry and searching for some choice morsel for dinner. Booze, our pet kitten and mascot, being directly in the hawk's line of vision, the bird swooped down on the little creature. Then, with the unfortunate kitten gripped in his talons, the hawk ascended into the air. But Booze was resolved not to succumb without a struggle and he resisted so vigorously that the hawk relinquished his grip and the kitten fell to the deck and scampered away to safety. Some of the ship's officers then tried to kill the hawk, but the bullet fired at him went wild and the bird flew away.

The Seguranca steamed past Sand Key at dusk on June 3d, the three tall masts of NAR (the Key West naval station) standing out in the distance. Soon afterwards the lighthouse signaled us with a Morse light and the captain asked me to go on the bridge and find out what was wanted. The lighthouse asked the ship's name and then said GN (good night). We steamed in under the big guns of Fort Barrancas, guarding the entrance to Pensacola Bay and the naval station on the morning of June 5th. As soon as we were sighted on shore, the Naval Aviation School sent up several flying boats, which hovered over us like huge eagles.

Pensacola is a most interesting place and the Seguranca, being the first two-funnel steamship ever seen in the harbor, attracted considerable attention.


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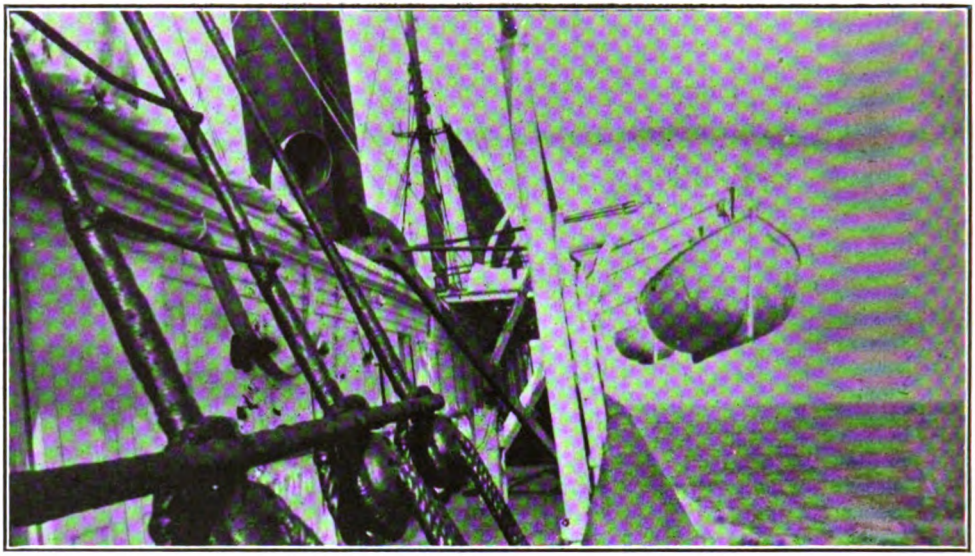

*This photograph pictures the vessel when she was in the heart of the war zone. The life-boats swung over the side of the ship have just been inspected and provisioned*

The Pensacola News said: "More than usual attention was given to the arrival of the Seguranca because she has two funnels and is equipped with wireless."

A day or two after our arrival a small hurricane struck the vessel, causing her to drag her anchor. We narrowly escaped collision with three other vessels before anchoring again.

A visit I paid to the NAS (Pensacola station) deserves mention. This station has a big flat topped aerial and a standard 2 k. w. quench gap set. For receiving, galena with an audion amplifier is used. Continuous service is maintained with the Key West naval station and NAT (the New Orleans station). For long distance work a big 10 k. w. low frequency set, with a non-syncronous rotary gap set, is employed. Ninety-three standard copper plated jars are used as the condenser for this set. The Aviation Training School, the only one conducted by the government, is located on the bay near the wireless station and is one of the prominent points of interest in Pensacola. It consists of nearly a dozen large tents, each housing a hydro-aeroplane. A big repair shop and storeroom for aeroplanes stand nearby.

Our stay at Pensacola came to an end only too soon and at length we steamed away for Europe. When only a few days out of port we ran into a heavy squall. The seas, lashed by the heavy winds, mounted skyward and formed waterspouts all around us; luckily, none came near enough to cause any serious damage. Several flying fish, probably attracted by our lights, were blown aboard during the storm and the sailors had them cooked for their breakfast.

The wireless gave us the latest news from Cape Cod and Poldhu, England, every night during the voyage. I was able to copy the French war news from F. L. (the Eiffel tower) up to 1,600 miles. We also used the Eiffel Tower's time signals to test the accuracy of the ship's chronometer. As we neared England I was surprised at the various calls I heard. Some had four station letter calls, such as ZAAW and ABMV; others used two letter calls, such as CX; some had number calls, such as A27 and 51M; and some used unassigned calls, such as XXJ and YCF. Nearly all communication was carried on in different codes.

I copied on July 7 a message sent by Poldhu to the steamship Saxonia, conveying a warning regarding a bomb which it was feared had been placed on



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the vessel by a fanatic who had attacked J. P. Morgan.

We entered the war zone on July 8. At night, as a precautionary measure, the American flag at the Seguranca's stern, the name of the vessel and the letters "U. S. A.," which were painted on both sides of the ship, were illuminated. The lifeboats were slung out over the sides, too. Steaming up the English Channel, we sighted two submarines running awash, but as they flew no flag we could not tell their nationality nor did we care as long as they remained at a considerable distance from us. Many armed trawlers were cruising about. The majority of these vessels carry wireless, with a limited range, due to short aerials. The latter usually consists of four wires arranged as a long oblong and not the flat topped type commonly employed in America. The sets on these trawlers are invaluable. GLD (the Land's End Admiralty station) frequently sends out reports regarding the enemy's submarines and the trawlers immediately go in search of the enemy's under sea craft. Two German submarines, it was reported to me by wireless one night, were within fifty miles of us. Most of our crew had all their belongings packed and slept fully dressed till morning, but nothing happened.

With the exception of torpedo boats and armed trawlers we saw no war vessels until we reached Dover, where there were several big battle ships behind the breakwater. While steaming through the Strait of Dover it is necessary for vessels to pass between two lightships anchored near together. The remainder of the Channel, some twenty odd miles across, is mined or set with huge nets to entrap the German submarines.

At Deal the Seguranca was stopped by a patrol boat, the officers on which examined our papers. Many vessels of various neutral nations were being held for examination. After a few hours' detention we shipped a pilot and proceeded to London under a torpedo boat escort.

While off Margate we heard the heavy firing of the big guns in France. As we passed up the Thames the firing gradually ceased. At one point in the river a pontoon bridge has been built by the army for quick transportation of troops and supplies in case of necessity. A little farther on was an encampment of soldiers, their tents being dyed green to harmonize with the grass and make them invisible to the occupants of scouting aeroplanes. There was also a long shed, probably filled with explosives, that was covered over with a netting as a protection against aeroplane bombs.

*The Seguranca at Pensacola. The American flag was painted on her side in order to identify her as a vessel of a neutral country*

All of the Seguranca's lights had to be covered at night and even the ship's generator was ordered shut off at ten o'clock.

Our trip up the Thames was full of interest, due to the conditions resulting from the war. The progress of the Seguranca was not hindered, however, and finally I found myself in London. I do not intend to write at length regarding

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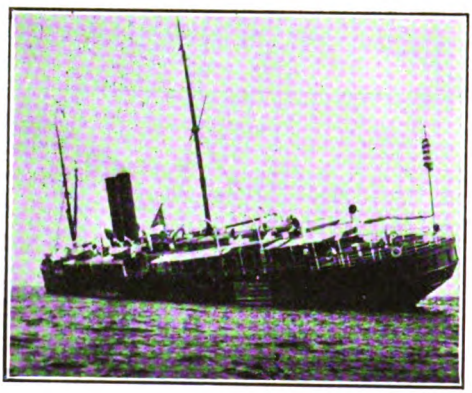
my stay in that city. I was impressed, however, by the precautions taken to guard against attacks by aeroplanes. Huge searchlights swept the sky at night, but in spite of this precaution there were two raids on the outskirts of London while we were there. High angle



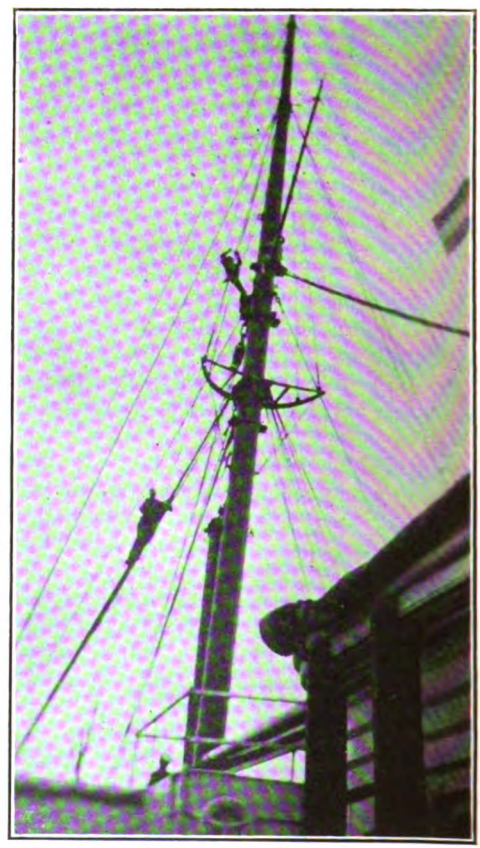
*A short time before the ship steamed away from Pensacola she was struck by a heavy hurricane. When the photographer snapped her she was listing considerably to port*

anti-aeroplane guns are mounted on some of the buildings.

Because of the war, the stevedores were shorthanded so we remained five and a half weeks in London. This gave me a chance to see the city. Marconi House, of course, was especially interesting to me. I was stopped many times by officers who tried to persuade me to join the British forces and heard recruiting speeches and concerts in practically all parts of the city. The parks are used to drill the raw recruits.

When we steamed away from London we were enveloped in a typical English fog all the day down the river. As we neared the mouth of the Thames the fog lifted, disclosing to our view a small flotilla of war craft. There were five torpedo boats, four battle cruisers and a couple of big dreadnaughts. An aeroplane put out from the Chatham Navy Yard and, after inspecting us, flew back. At Deal we were stopped a short time. Near Dover we saw a big balloon search for floating mines and enemy submarines. There was also an attendant boat nearby with a specially constructed landing platform for the balloon. After we passed Dover I put the aerial up again.

August 19th lives in my memory as the busiest day of the voyage for me. In the morning the MHF (the Baron Erskine) reported being chased by a submarine and one of the patrol boats said she was coming to her assistance. A little later the MFC (the Arabic) reported a sinking steamer, believed to be the steamship Ugansley. About an hour later the Land's End station sent me a warning of a floating mine in our vicinity. At fifteen minutes to three o'clock in the afternoon I heard somebody calling SOS. I took a pencil and copied:



*Taking down the aerial in the Strait of Dover by order of British officers. One of the sailors lost his balance and just saved himself from falling by grasping a stay*

"Torpedoed by two enemy submarines. Crew ready to take to the boats. Can't read any one's signs because of the steam whistle blowing."

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The operator who sent this message then gave his position, but did not sign. He was, however, either on the steamship Arabic or the steamship Nicosion. We were 200 miles away so we did not go to the aid of the distressed vessel.

Next come an S O S from the steamship Bovic (GDO). This was at half past five o'clock in the afternoon. The message gave the Bovic's position and said that she was being chased by a submarine. A patrol boat said that she was coming to the Bovic's aid. At half past seven o'clock the Bovic reported that she was sinking. The Vice Admiral at Queenstown sent the vessel a message through ZAAW (patrol boat) saying that he was expecting to pick up the Bovic at nine o'clock that night. After that the air was comparatively quiet.

The steamship Georgia (GDT) asked me two days later if we had a doctor aboard. It seems that the chief engineer had just met with an accident, having seriously wounded himself with a rifle, and the captain wanted a doctor's services immediately. We had no doctor so he called CQ and asked for one. A reply came from the Minnehaha (MMA) saying that there was a doctor aboard that vessel. GDT asked for the doctor's services, but MMA insisted that he must have a message to that effect. Then, to make sure that the message wasn't "faked" by some German war craft, the Minnehaha asked the Georgic to repeat the message or to confirm it in the MV code. After this code message had been sent the captain of the Minnehaha told the Georgic to proceed to rendezvous XJNPJ, where a boat containing a surgeon would be lowered. An hour or two later the captain of the Minnehaha sent a message to the effect that the wounded man had arrived on board that vessel.

This occurrence constituted the last noteworthy incident of our voyage. To be sure, we sighted a small iceberg a few days later, and a short time afterward the steering gear cable parted, necessitating the use of the emergency wheel at the stern. But iceberg and accident were overshadowed by the realization that the cruise of the Seguranca was nearing an end. And so with thoughts of the war far behind us the Seguranca steamed past the lights of Coney Island and headed up the bay while on the lips of those on board was framed a word full of meaning—home.

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## THE STRANDING OF THE SANTA CLARA

The steamship Santa Clara ran aground on Coos Bay Bar, Oregon, early in the morning of November 2. C. E. Goodwin, Marconi operator, immediately called the station at Marshfield, Oregon, saying that the vessel was aground and asking the aid of the life saving corps. By this time there were indications that the ship was in danger of breaking in two and Goodwin sent the S O S. The Adeline Smith, which answered, was only a short distance from the Santa Clara, and Goodwin asked her to stand by. The Willamette also answered, but she was twenty miles north of Coos Bay and could not give immediate aid. Boats were launched to transport those on the Santa Clara to the shore, the wireless being operated almost up to the minute the last one left the vessel.

## WIRELESS TELLS OF FIRE AT SEA

A marconigram received in New York City on November 8 tells of a fire which started on the French Liner Rochambeau while she was on her way from New York to Bordeaux carrying a cargo which included cartridges and cotton. The message, which was sent by the commander of the vessel, Captain Juham, follows:

We are fighting fire in reserve coal bunker. If we do not succeed, will put into Halifax. Everything all right and no danger. Juham.

That the flames were extinguished was told in the following marconigram which was received in New York on October 9:

Have succeeded in extinguishing the fire and am proceeding to Bordeaux. All well on board. Juham.

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# Reminiscences

## The Story of an Operator Regarding Incidents at Sea and Ashore

**By Irving Vermilya**

ALTHOUGH the ranks of the United Wireless operators are gradually thinning out there are still a number of them in the Marconi service and, like myself, I suppose they take pleasure in recalling the old days when there were no regulations at all and the fellow with the most power in kilowatts had the best show. Most of my old United days were spent on board the North Star of the Maine Steamship Company, or the same owners' Northland. Indeed even my Marconi days, up until about a little more than a year ago, were spent on the Northland, with the exception of one trip on a private yacht. If anybody in those days mentioned wireless on the North Star or Northland, their thoughts involuntarily turned to either old Hiram Hilkins or myself; it seemed as if there was a permanent arrangement under which we swapped ships every once in a while, so as to break the monotony of the same crowd and scenery.

The North Star, back in the United days, when only one operator was aboard, was surely some job. My chief duty was to call up 42 Broadway and let him know we had left without slamming off the posts of the dock. Then I would listen to the talk of a few amateurs up the East River, and send in our O. S. report at every old rock we passed all the way to Stratford. Along about 10 p. m. I would call old WN (Wilson's Point, Conn.) or BG (Bridgeport) and say ND—nothing doing—and give them a good night. There was nothing to do then but go to bed. I laugh when I think of that bed. It was a box hung on the wall inside the wireless coop and supported by two chains. Every time the boat pitched the chains doubled up and I would have to hang on to the helix to keep from going out on the floor. The wireless house was only about eight feet by six, and about seven feet high; in consequence the box which served for a bed was less than five and one-half feet long and three and one-half feet wide. I am six feet tall. You can imagine how I fitted in. But despite the uncomfortable conditions I stuck to the old ship for a number of years; and after the Marconi Company took over the United, conditions were bettered and I willingly stayed on that line.

I became a wireless operator in rather an unusual way, I think. Long before there was any United Company and when the Marconi was quite young, I put up an amateur station at my home in Mt. Vernon and tried to get in touch with a fellow in New York. I failed because I did not know how much power was necessary to go fifteen miles overland. I was trying to do it with a two-inch coil, and as detectors were crude at that date, there was nothing doing. I heard my friend, however, for he had a sixteen-inch coil and plenty of power. With the assistance of a liberal father I gradually saved up enough money to secure a one-quarter k.w. transformer. This made quite a disturbance, but not enough; so I kept getting larger transformers until I eventually obtained one of the 5 k.w. closed core type. This made considerable rumpus, and my efforts to equip other amateurs so as to have some one to talk to, became so energetic that one day I received a letter from the United company offering me a job, providing I would shut up my station while away. This looked good to me, but the job was to be on an old oil


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tanker and I immediately side-tracked it. Not long afterward the Caracas, a Red D Line passenger ship, was offered, and I set out on my first trip to South America.

I thought afterwards that I had plenty of nerve to go to South America first trip, for I had never been out of sight of land before. I was seasick for eleven days. When I finally overcame the malady, however, I enjoyed myself very much. We landed at Caracao, a Dutch island, and there I had my first experience in a foreign land. I can well recall coming to a bridge which I wanted to cross, but I was held up at the entrance and the gateman said something to me I did not understand. I told him to talk United States, whereupon he gave me a card printed in English which stated that to cross the bridge it cost one cent if you took your shoes off, and two cents if you wore your shoes. I burst out laughing. I was tempted to take 'em off, but on second thought I paid my two cents. I did not have any pennies, it so happened, so I gave him a nickle. He refused to take anything but silver, and as a quarter was the smallest change I had in silver, I gave him this. You should have seen the change he gave me! There was so much of it, it looked to be about forty-eight dollars in copper, brass, iron, zinc, tin, bronze and (in one small coin) what appeared to be wood.

It filled both my coat pockets and when I had crossed the bridge I was glad to come upon a small car pulled by a mule. I got aboard and had a very nice ride; everything went well, in fact, until I tried to pay my fare. He who discharged the dual functions of conductor and driver stopped the car and came around when the proper time arrived. I was the only passenger, and he evidently knew I was an American, for he asked me for a ten-cent coin. I wanted to give him some of the junk the bridge man had given me, but he did not seem to want it. I gave another quarter finally and the junk money he returned filled another pocket. I was given a little receipt for my fare, and also a blue ticket with something written on it. Afterward, when I met a man who spoke English, he told me it was a sort of a receipt to show I was a perfect gentleman.

I had a chance to demonstrate whether his surmise was correct when I was sent aboard the yacht Emeline as operator for Robert Graves and had one of the finest trips imaginable. We started for the Panama Canal and all enjoyed every moment of the voyage. The yacht was furnished luxuriously. We carried a cabaret along, consisting of Hawaiian singers and dancers and a moving picture apparatus which I operated in the evenings, and for which the owner paid me a special salary. There was also an automatic piano, a $1,500 organ, electric chimes and an electric fountain which sent

*The life of a wireless operator is not made up entirely of dull routine, as this photograph shows*

forth streams of perfumed water. We were headed for Kingston, Jamaica, but one of the ladies' dogs got seasick and we to turn back and land at Norfolk, Va. While we were in Norfolk a funny incident arose. Mr. Graves had forgotten the combination on the safe, and as he wanted to purchase some supplies he did not know what to do. We finally found a safe opener by trade and after a few moments of tinkering he opened it. I came on the scene about the middle of the operation and was given an awful scare—I thought it was a robbery in full swing! I did not send an S O S, but I did something about as bad: He was a tough looking individual and I asked him what he did at night. This got his temper up and he told me a few things.

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When the job was finished and Mr. Graves asked him how much it would be, he said: "Fifteen dollars; ten for opening the safe and five for the operator getting fresh."

We did a fine wireless business; at every port we entered the owner sent ashore by wireless a batch of invitations to attend dinner or a banquet on board, and we received all our answers by the same means. When we reached Colon Mr. Graves took me with his first day party across the canal by rail to Panama. He then appointed me guide and each day I took ten men from the crew across the canal from one end to the other. I was paid ten dollars a day for this and expenses for all, including dinners and cigars. As a climax Mr. Graves bought me a twenty-dollar panama hat. I was rather sorry when those yachting days were over.

When the summer season ended I went back on the Northland. I stayed there until I was detailed to fill a vacancy which occurred at Sagaponack. We communicated with my old ship, the Northland, from the land station, and I often wondered if the operators on the vessel derived as much pleasure out of their jobs as I used to.

In my day, my second man, Dugan, and myself rigged up in the wireless room what we called a "jouncer." It consisted of an uninsulated wire connected to the lounge where visitors usually seated themselves. One end of the wire was laid gently under the thin covering of the lounge and the other end was hooked up to the business end of the ten-inch coil. There was usually something pretty brisk doing when the key was pressed on that set, let there be no mistake about that. The only trouble was that Dugan or myself would forget ourselves and sit there while thinking some sweet thoughts, and of a sudden the other fellow would press the jouncer and the one on the couch would go floating out the door with a six-inch spark following close on the point of contact. I say "floated" because he never had time to stop and jump.

We tried a new arc light one day, and some of the colored waiters got interested. We had one old fellow who had a known record for being about as slow as an Erie freight and who always chewed tobacco, despite the fact that he had false teeth.

We were explaining the wonderful light to him and he had about one-half of the couch covered with his person when Dugan pressed the key. I ducked the tobacco! The false teeth broke one of the windows. The old colored man never stopped until he got safely in his cabin down aft and locked the door.

We always had plenty of callers while in Portland. I dare say many amateurs can remember my "jouncer" without any trouble.

## COMMUNICATION WITH GUATEMALA CITY

A step toward increased efficiency of communication between the countries of the Western Hemisphere was taken recently, when messages were exchanged between the naval wireless station at Arlington, Va., and the new radio station erected by the government of Guatemala at Guatemala City.

To commemorate its opening, Secretary Daniels announced, messages of felicitation were exchanged between the President of Guatemala and the President of the United States. The messages were exchanged by radio telegraphy between the Arlington station and the government radio station at Guatemala via the naval radio station at Key West.

## MEDICAL AID BY WIRELESS

A wireless call was sent out from the steamship Radiant on Sunday, October 11, for the treatment of an engineer who had for three days remained unresponsive to the medicines administered by the captain.

Marconi operator W. C. Thompson communicated with the station at Tampa, Fla., and then with the Southern Pacific steamship Comus, from which vessel doctor's advice was obtained and the sick man greatly relieved.

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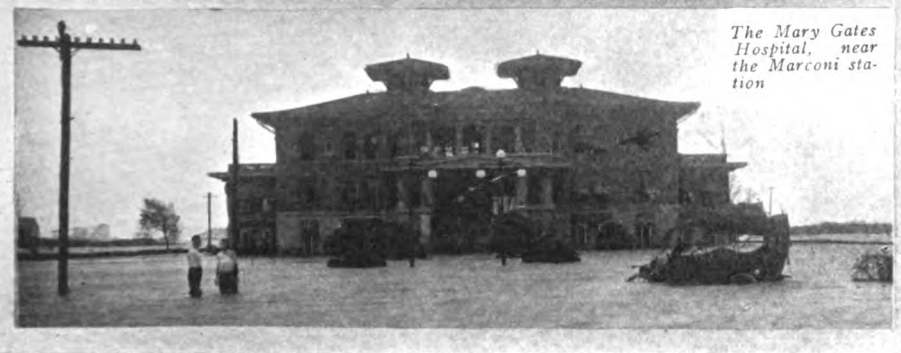
*Port Arthur, Tex., seen from atop a wireless tower after the recent tornado*



*The Mary Gates Hospital, near the Marconi station*

*Operator Foley on the roof of the Marconi station*

*The Marconi station after the storm*

*The wrecked mast of the Marconi station*

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RADIO AMATEURS LINE UP AS DEFENSE UNITS
WILL FORGE LINKS OF WIRELESS INTO A PATRIOTIC CHAIN
NATION'S WIRELESS MEN TO ORGANIZE
MARCONI HEADS MOVEMENT
READY FOR EMERGENCIES

# National Amateur Wireless Association

## A Few Comments of the Press Following the Announcement of its Organization Given in Brief

ARTICLES comprising more than 2,000 words announced the organization of the National Amateur Wireless Association in the New York newspapers of October 31. It is impossible to reprint here the many columns of favorable newspaper comment made all over the country, but the few extracts which follow give some idea of how the press of the country viewed the undertaking.

On its editorial page, the New York Sun said, in part:

"The National Amateur Wireless Association—a comprehensive organization formed for the development and training of amateur wireless workers throughout the country—comes into existence tomorrow.

"Its founders, headed by Guglielmo Marconi, of the Marconi Wireless Telegraph Company, hope to interest the 200,000 amateurs in a greater development of their experiments by co-operative or group working, so that in case of emergency the nation may have a reserve body of operators.

"It is the view of the organizers that the amateur wireless operator, whose efforts are generaly frowned upon by Government officials as well as other individuals, should be encouraged; that the merest tinker may develop into an enthusiast and by proper study become a great radio engineer. The association plans to help young men in this field. Co-operation,, coupled with direction of experimental work, is the means by which this service is to be performed. Existing wireless clubs and organizations will be recognized and properly accredited officers may have a share in the councils of the national association.

"Every amateur who is properly indorsed may join as an individual. According to his abilities and geographical location he will be entered for eligibility in an existing club or association, published recognition of anything noteworthy he accomplishes will be given, and in due course admittance to an engineering body will be arranged. Progressive courses of study will be placed in each member's hands, experiments far removed from text-book humdrum will be added, and a monthly bulletin of new calls and other items included.

"One arrangement that is being planned is this: Small clubs in their entirety or larger organizations divided into groups will be permitted to affiliate with some military organization as accredited members and officers of signal corps. Next summer these corps will enter military training camps similar to those recently held in the East. Thus a third line of defence will be available. The importance of this is emphasized by the fact that 1,100 men employed by the Marconi Company were requisitioned by Great Britain for wireless service at the outbreak of the war.

"It is pointed out that the United


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States in time of war would need hundreds of operators and these would be available. Among the distinguished men in the advisory board of the National Amateur Wireless Association is Major William H. Elliott, a signal officer of wide experience and Adjutant-General of the Junior American Guard, who will serve as military adviser.

"Mr. Marconi will be president and J. Andrew White, of the Marconi Company, administrative officer. Mr. White is editor of THE WIRELESS AGE. Clayton E. Clayton, associated with Mr. White, will be managing secretary; Prof. Alfred N. Goldsmith, of the College of the City of New York, an instructor in radio engineering; Prof. A. E. Kennelly, of Harvard, another radio expert, and Profs. Samuel Sheldon, of Polytechnic Institute, Brooklyn, and Charles R. Cross of Massachusetts Institute of Technology, and E. E. Bucher, instructing engineer of the Marconi Company, also will act on the advisory board. To assist them will be a national council made up from existing clubs, State and interstate organizations.

"The headquarters of the new organization will be at 450 Fourth avenue. It is to be strictly a co-operative body. Personal contact with national officers will be possible through conventions to be arranged."

### Promotion of Existing Organizations

The New York World included in its 200-line article, the following:

"A new organization for preparedness will become a reality to-morrow when the National Amateur Wireless Association enters upon its official existence.

"According to Mr. White, the association has been formed in order to develop and help young men interested in the subject, so that, in case of war, there will be a large body of trained wireless operators upon which the United States Government can rely. There are fully 200,000 amateurs in this country who need and are anxious to receive the instruction the association purposes to give.

"Close relations will be established with a large army of lieutenants, in the persons of those active in the direction of the many community clubs, State and interstate associations. Existing organizations will be aided to further growth, and, where a community lacks a club, every effort will be made to establish one. Officers of existing clubs will be admitted to the national council and conventions will be held at regular intervals.

### Importance of Signal Corps

"Membership in the National Association will be open to every amateur who is properly indorsed. According to his abilities and geographical location he will be entered in some existing club or association and published recognition of his accomplishments will be given and eventually he will be admitted to some engineering body. He will be supplied with progressive courses of study, including experiments, and everything that a body of national officers of wide experience finds essential to the welfare of the amateur will be provided for.

" 'Within a short time,' said Mr. White yesterday, 'it will be possible for small clubs in their entirety, or larger organizations through division into groups, to affiliate with military organizations as accredited members and officers of signal corps. Next summer these signal corps will enter military training camps similar to the one recently held at Plattsburg. Those who wish may become full members of a third line of defense for the safeguarding of the Nation in event of war.

" 'Should this country be invaded the work of the wireless signaling corps would be of the utmost importance. Wireless is a most important adjunct to the modern war machine. A reserve corps made up of amateurs would be of inestimable value to the Nation.

" 'We would have difficulty at the present moment in mustering sufficient wireless men of experience to provide for the defense of even a small strip of our coast. The solution of the problem lies evidently with the amateurs. Official figures give 3,836 licensed amateurs. I can say conservatively that double that number could pass the examination. Under the guidance of the National Amateur Wireless Association a reserve force of competent wireless operators adequate

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National Amateur Wireless Association
This is to certify that
Ray Dio Enthusiast
having furnished satisfactory credentials and having shown that he is a student of Radio Communication is hereby accepted in fellowship and full membership in THE NATIONAL AMATEUR WIRELESS ASSOCIATION of America. He agrees hereby as shown by his signature, to promote the interests of experimental radio work and at all times to observe the Laws of Radio Communication of the United States.
Signed by:
Member
Approved:
Executed by
Acting President
President
Membership expires
Managing Secretary.

*The steel engraved membership issued to each member. It is printed in green, gray and black, with halftone shadow background, and carries the signatures and official seal of the Association*

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for all our needs can be developed within a year.'"

**Interesting and Valuable Experiments**

The New York Press devoted a full column to the announcement, saying in part:

"The formation by the leading radio experts of the East of a country-wide organization to be known as the National Amateur Wireless Association, by which amateur wireless enthusiasts can be aided toward maximum efficiency and grouped into national defense units, was announced yesterday. Guglielmo Marconi will head the movement.

"By means of the proposed association, which becomes officially existant to-morrow, November 1, the country's radio engineers hope to direct the activities of the many thousand amateur wireless enthusiasts along standardized scientfic lines.

"Marconi will act only in an advisory capacity. In fact, his position at the head of the new league is the first official post he ever has accepted. The active work of the association will be carried on by J. Andrew White, editor of THE WIRELESS AGE. Clayton E. Clayton is to be secretary.

"Major William H. Elliott, a signal officer of considerable experience and one of the leaders in a juvenile patriotic organization known as the Junior American Guards, is to be vice-president of the association. Upon his shoulders will rest the highly important work of developing, from the countless wireless enthusiasts of the country, efficient military signalers ready to fill up the gaps in the Nation's wireless reserve in time of war.

"The first act of the experts heading the new movement will be the recognition of various community wireless clubs, State and interstate associations.

"The most important work of the association will be in finding the true radio enthusiast, finding equally as active coworkers for him, and directing their experiments along the most productive lines.

"There are almost 200,000 amateur wireless enthusiasts in this country, ranging from the youngster with a back yard communication set to the wealthy radiographer with an expensive and highly efficient set of instruments. A large percentage of the 200,000 belongs to wireless clubs or associations, but, with few exceptions, such organizations fall far short of their purpose.

"The radio experts backing the movement say they have devised many interesting and valuable experiments and wireless stunts that the average enthusiast never heard of. It is by supplying such channels of instruction and development to the growing crop of wireless operators the association will organize a large corps of radio engineers and experts. The association will institute a bulletin service, keeping its members constantly posted on wireless affairs.

"Perhaps the most important phase of the national wireless plans is that which deals with training military wireless operators. It is planned to have those of the youngsters interested in such branches of the work form signal corps detachments of the Junior American guard. The older wireless enthusiasts will be used as instructors.

"From a statement made by Marconi to directors of his company recently, it was learned that Great Britain, despite the thousands of radio operators on board her warships, in her army and aboard the many vessels in her merchant marine, had to call time and time again for recruits with a knowledge of wireless telegraphy. It is understood that even the schoolboy wireless clubs in England have rendered valuable service to their country. The new association hopes to fit many thousands of the country's amateur experimenters to pass the Government tests and be ready for any emergency.

"By reason of its organization the many operators and their home stations throughout the country are to be grouped for military usage. Each member of the association will receive information concerning all radio stations, and will be placed in a position where, with average application, he can make himself a military necessity."

**Prediction of Celerity in Organizing**

The Christian Science Monitor, of Boston, had this to say editorially:

"Marconi is co-operating heartily with the National Amateur Wireless Associa-

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tion in which it is planned to enroll the 200,000 persons in the United States, who, for the love of it, have taken up with the new mode of communication and have acquired apparatus and mastered use of it. He foresees much aid, both theoretical and practical, from the co-ordinated and directed service of this large group. Evidence of their capacity to serve the Government has been shown since the war opened in more than one strategic way. The celerity with which schemes of this kind are worked out in the United States, once the plan is given a definite shape by a man like Marconi, well-nigh insures the ultimate achievement."

**Large Membership Expected**

An editorial in the Rochester, N. Y., Chronicle stated:

"The extent to which wireless telegraphy has interested American students of electricity is shown by the formation of a National Amateur Wireless Association, with the intention of systematizing instruction to wireless enthusiasts, their clubs and state and interstate organizations. The membership roll of the association is to be wide open and every amateur in the absence of a local club or organization, can join the parent body as an individual by giving local references and receiving indorsement. It is almost needless to say that the membership of the National Association will be large."

A lengthy editorial in the Syracuse, N. Y., Post-Standard, said in part:

"Not long ago the average amateur wireless operator came into disrepute up and down the country for his habit of meddling in commercial and governmental business. Youths with sufficient ability to construct simple wireless systems continually eavesdropped, interfered with legitimate radio work and generally made themselves nuisances.

"It now develops that the amateur wireless man has his use in the world.

"Older radio experts have decided to turn the activities of every amateur in the country into work that will be valuable instead of destructive. A country-wide organization, to be known as the National Amateur Wireless Association will be formed, and its members will be aided toward maximum efficiency and then grouped into national defense units.

"The first problem is to organize the 200,000 amateur radio workers into clubs and other divisions. When this is done, the leading men of the country in wireless knowledge will lend their services for instruction.

"The amateur has come into his own and his hitherto frowned upon labors will shortly be recognized as of value when directed into proper channels."

Scores of other press clippings from all quarters of the country have been coming in daily to headquarters. Space does not permit printing even a small fraction of the newspaper comment. The unanimous support of the press, however, is appreciated by the officials of the National Amateur Wireless Association and this opportunity is taken to thank the leading papers of the North, East, South and West for their unsolicited efforts in the Association's behalf.

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## WIRELESS INVENTIONS AND THE PRESS

So seldom does this magazine find a true expression of its principles in the periodicals that occupy the field of semi-technical reporting, it is particularly pleasing to find our good neighbor the Scientific American once again in full accord with our policies on "freak" news. On the editorial page of a current number is an observation we consider worthy of reprinting in full. It remarks:

"It has been a matter of considerable surprise to many that the columns of the Scientific American have failed to contain descriptions and illustrations of several of the portable wireless receiving sets recently heralded as marvelous and revolutionizing inventions by both the daily press and a small portion of the semi-technical press. Accordingly, an explanation is due.

"It is simply lack of knowledge regarding the possibilities of radio communication that causes the laity to marvel at the portable instruments that appear periodically. If the present stage of the art were fully understood—or even partially familiar to the layman—

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these *soi-distant* inventions would seem commonplace indeed. In most cases it would be immediately evident that they were in actually nothing but more or less worthy replicas and modifications of instruments that have been in regular use for several years. But to appreciate fully the merits of these portable sets and the work of their designers, it is necessary to review briefly the possibilities of wireless communication.

"There is nothing complicated nor truly mysterious in the reception of wireless signals. The electro-magnetic waves emitted by a radio transmitter travel in all directions at a speed of 186,300 miles per second, and have the power of creating certain effects at distant points if properly gathered and sent through appertinent apparatus. So powerful are the present-day transmitters that, given the proper apparatus, it is possible to intercept radiograms with small antennæ, such as an ordinary steel clothesline, a metal bedstead, an ordinary umbrella, any large metal object that is more or less insulated from the ground—even no antennæ at all if the station sending the messages is in the immediate vicinity. As for the apparatus, it may be reduced down to a chip of mineral possessing the desirable rectifying property, on which presses a piece of copper or brass wire, forming the "detector," which is shunted by an ordinary telephone receiver. The ground connection, which is not essential but if available will permit of the use of a smaller antenna for a given strength of signal, may comprise a metal rod driven a few inches into the ground, a wire wrapped a few times around a water or gas pipe, or any object which makes good electrical contact with the earth. Could anything be simpler—or more compact?

"For transmitting wireless signals over a short distance, a small induction coil and a battery will suffice. Even a common buzzer may be substituted for the induction coil, if so desired. Compactness is as readily obtained as in the receiving set.

"Yet marvelous wireless 'inventions' in the form of portable apparatus that may be carried in one's vest pocket and used in receiving messages sent from stations hundreds of miles distant, employing an umbrella as the antenna and a metal rod driven a few inches into the ground, continually find their way into the press. In some instances it is a beginner in the field of wireless experimentation who discovers for himself that almost any combination of odds and ends will comprise a receiving set for powerful signals, and in all good faith assumes that he has suddenly become a benefactor to mankind. But more often there is evinced a deliberate attempt by a well-versed person to secure gratuitous publicity and short-lived fame by preying upon the public's and the press's lack of technical knowledge."

That is exactly the way THE WIRELESS AGE feels about it.

## WIRELESS REGULATIONS

At the outbreak of the present war immediate steps were taken by the governments of the belligerent countries to bring the use of wireless telegraphy under direct official control, and all stations not operated under government supervision were ordered by the respective governments to be dismantled. This action, as might well have been expected, did not stop at the belligerent countries, but extended to neutral governments all over the world. It was necessary that steps should be taken by non-belligerent powers to ensure that their neutrality obligations were not violated by the utilization of wireless stations in their territory for the transmission of communications of a non-neutral character. Consequently, almost all countries throughout the world issued special regulations relating to the use of wireless telegraphy; but as these regulations were all made with the same object in view they naturally differ but slightly from one another. . . .

The International Bureau at Berne has become an organization of supreme importance, thanks to the zealous, economical and efficient manner in which it is conducted. To this organization is entrusted the work of preparing and circulating, in accordance with article 13 of the Convention, particulars regarding every station located in countries adhering to the Convention. . . .—From "The Year Book of Wireless Telegraphy and Telephony," for 1915.

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## Chapter XVI

### Type 107-A Receiving Tuner

INSTRUCTIONS have been issued to the marine service of the various divisions of the Marconi Wireless Telegraph Company of America for the reconstruction of the former type 103 and valve tuners to allow the reception of wave-lengths up to 2,800 meters. After either type is altered in accordance with the following directions, it is to be known as type 107-A.

The original design of these tuners affords a maximum wave-length adjustment of 600 meters in all circuits. By a slight rearrangement of apparatus and wiring the maximum value may be doubled. In consequence the 107-A tuner is suitable for the reception of time signals at a wave-length of 2,500 meters.

A brief review of the prominent features of the type 103 and valve tuners may assist in clearing up the manner in which the necessary changes are to be made.

(1) In the original design the aerial tuning inductance comprises two coiis connected in parallel.

(2) The intermediate circuit is shunted by a variable condenser of .01 microfarad capacity.

(3) The inductance coil of the detector circuit is shunted by a small variable condenser of .0001 microfarad capacity.

(4) The elements of a circuit are of such value as to allow conditions of resonance throughout.

(5) A double pole double throw switch allows the detector circuit to be "tightly" or "loosely" coupled to the aerial circuit as desired. The switch has two markings, one known as "stand-by" and the other as "tune."

**Directions for Obtaining Increased Range of Wave-Lengths**

In order that adjustment to wave-lengths of increased value may be obtained, the following instructions should be carefully observed and corresponding alterations made at the repair shops of the various divisions.

(1) A special six-point double throw switch to be known as the "intermediate condenser switch" will be supplied and is to be mounted on the tuner between the two Marconi disc condensers. The switch has two markings, "stdbi" and "tune" respectively.

(2) This switch is connected, as per Fig. 2. When shifted to the "tune" position the intermediate condenser is connected in parallel to the intermediate circuit and in the "stdbi" position it is disconnected from the intermedate circuit and reconnected in parallel to the billi-condenser of the detector circuit.

(3) The two coils comprising the aerial tuning inductance are to be connected in series in lieu of the present parallel connection. Corresponding tap-offs are brought out to the aerial tuning inductance multiple-point switch.

(4) The detector circuit or secondary winding which normally contains 240 turns of wire is reduced to 160. These turns are removed from the end


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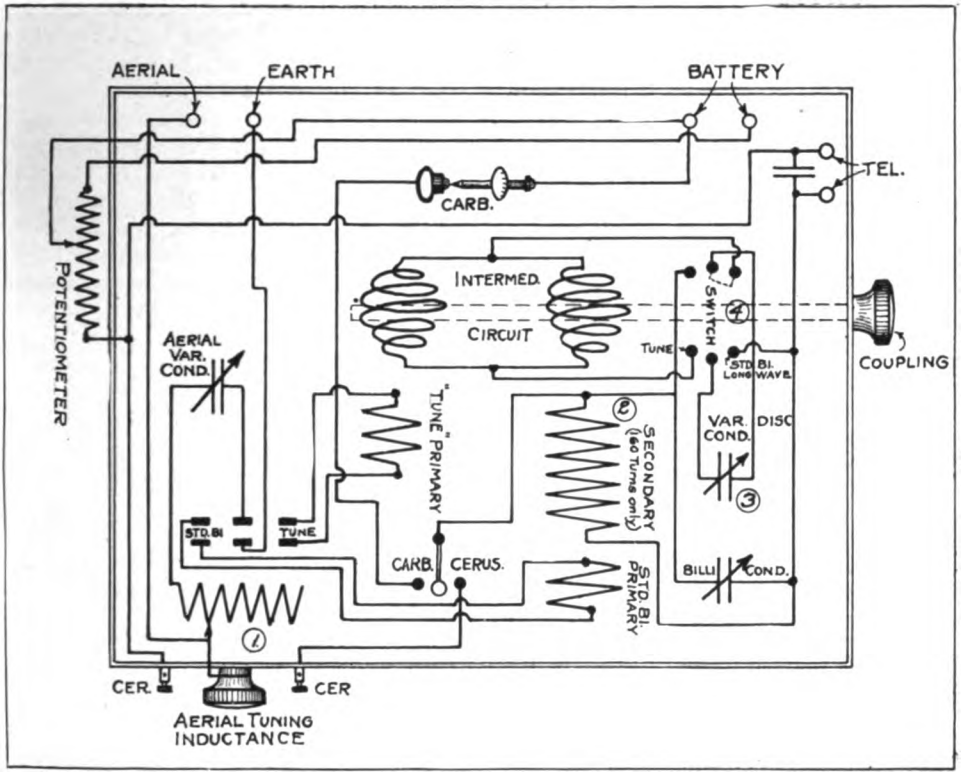


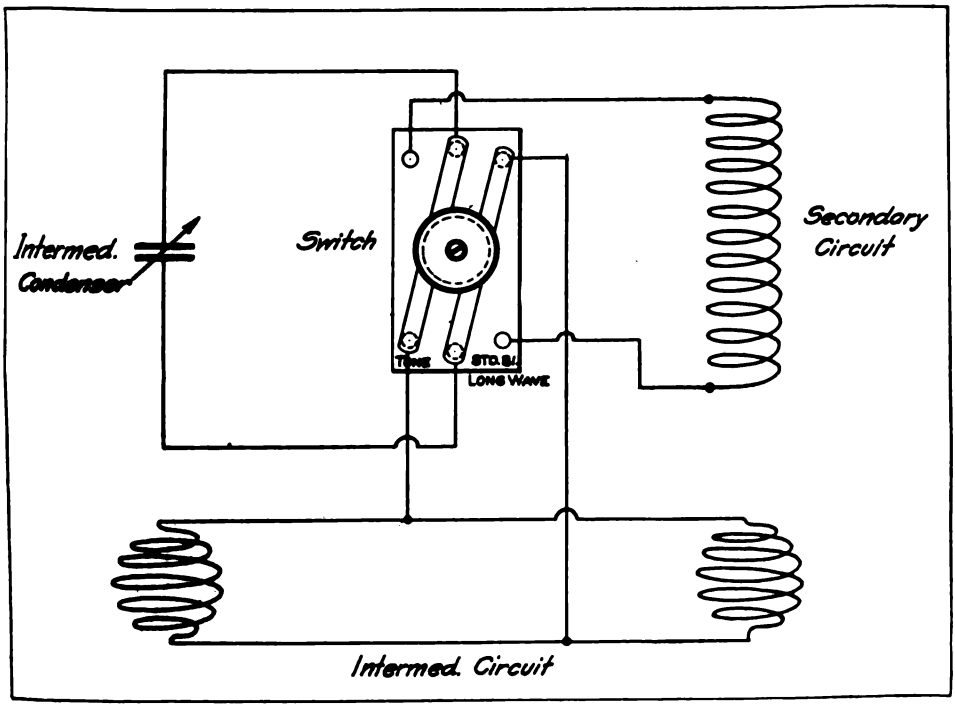


*Fig. 1 (above)* *Fig. 2 (below)*

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opposite that of the ball winding of the intermediate circuit.

The foregoing instructions having been accurately complied with, the aerial and detector circuits may now be placed in exact resonance at adjustments of increased wave-lengths.

**Instructions for Practical Operation**

(1) Wave-lengths above 800 meters can only be obtained when the D.P.D.T. switch and the intermediate condenser switch are in the "stdbi" position.

(2) With the connections given in (1) the intermediate circuit is not in use. The coupling knob should therefore be turned to zero to prevent needless energy absorption.

(3) At wave-length adjustments up to 800 meters, for purposes of sharp tuning, the D.P.D.T. switch may be shifted to the "tune" position, thus bringing the intermediate condenser into use. The intermediate condenser switch must likewise be shifted to the "tune" position and the coupling knob set at the angle desired.

(4) For tight coupling (stand by adjustments) at wave-lengths up to 800 meters the D.P.D.T. switch is shifted to the "stdbi" position. The coupling knob is now placed at zero. The intermediate condenser may, if desired, be shifted to the detector circuit or left to remain in shunt to the intermediate circuit.

(5) When the disc condenser is shifted to the detector circuit, careful adjustment must be made owing to the large value of capacity in this condenser as compared to that of the billi-condenser.

A complete wiring diagram for the converted tuner is shown in Fig. 1. The connections to the type F aerial change-over switch and the Cerusite detectors are shown in detail.

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## Applications of Wireless

Apart from the shipping industry, says A. H. Morse, A. M., I. E. E., in "The Year Book of Wireless Telegraphy and Telephony" for 1915, commerce has held itself strangely aloof from radio-telegraphy. Countless islands in the Southern seas await its advent to aid the full development of their rich natural resources, and an era of unprecedented prosperity would dawn for many a remote mine, plantation or other enterprise, could it have radio-telegraphic communication with its markets and bases of supply. The difficulties in the way are largely unreal. From the growing army of skilled operators many could be drawn who would be capable of performing other useful duties besides operating a wireless station. Running expenses, therefore, need not be high, especially as an adequate electrical power supply is generally available or could be installed to supply many needs in addition to furnishing the power for communication. Also, the maintenance expenses in connection with modern wireless apparatus are very nearly at the vanishing point. In respect of these cases just mentioned it is safe to say that radio-telegraphy is well ahead of its applications.

Now, as to the best way of furthering the development of the life-saving and other beneficent applications of radio-telegraphy. Undoubtedly nothing could be better than that shipowners, railway managers and others should take the wireless experts into their confidence, tell them their requirements, and what business could be relied upon if they were met. It is to such a keen and co-operative spirit that the world today owes the wireless fog signal which is now only entering on its career of usefulness.

These references to a few existing and suggested applications of the principles of radio-telegraphy are, perhaps, quite obvious, but collectively they illustrate the newly dawning fact that those principles are destined to serve us in many fields of endeavor. Thus will be enhanced an already glorious record, the crowning feature of which is the endowment of vessels with such powers that, though 500 miles may part them, they are but as—

"Ships that pass in the night and speak each other in passing."

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# The Physics of the Expanding Hot Wire Ammeter

By William H. Dettman

IN forcing a current against the resistance of a wire, a certain amount of electrical energy must be expended which manifests itself as heat. Let (R) be the resistance of the wire in ohms and (I) the current in amperes made to flow through it under the potential difference of (E) volts applied to its ends. Then the power expended in the wire is given by the equation:

$P = E\ I$ or $I^2\ R$ ..... (1)

Since $E = I\ R$, which appears as heat; the total energy (W) transformed into heat in ($t_1$) seconds

$W = I^2R\ t_1$ or $E\ I\ t_1$ Joules..... (2)

The unit of heat in the C. G. S. of units is the gram calory, which is the amount of heat required to raise one gram of water through one degree centigrade. One Joule equals .24 calory.

$W' = .24\ I^2R\ t_1$ calory.

This heat raises the temperature of the wire above the temperature of its surroundings, with the consequent increased rate of heat loss by radiation, convection and conduction. A body is said to give off heat by radiation when the heat is conveyed away from the body by ether waves, these waves being similar to light waves but much longer. A body loses heat by convection when it is immersed in a fluid such as air or water as a result of the molecules of the fluid coming into contact with the hot body and robbing it of some of its heat, thereby raising their own temperature. These molecules are then carried away from the heated object by the motion of the fluid. A body loses heat by conduction when it is in contact with solid objects, the molecules in contact with the heated body taking some of the heat from it and handing it on to other molecules further away from the body.

If the wire lost no heat by any of the methods referred to, all the heat would go to raise the temperature of the wire. If (W) is the weight of the wire and (S) the specific heat of the material of the wire, which may be defined as the ratio of the quantity of heat required to raise the temperature of the material through one degree centigrade, to that required to raise the same mass of water through one degree centigrade, then the temperature (T) acquired by the body after ($t_1$) seconds, assuming (R) and (S) remain constant, is given by the equation:

$$T = \frac{.24\ E\ I\ t_1}{WS} \quad \ldots\ldots (3)$$

The temperature of the conductor would continue to rise until it would melt, and thereby break the circuit. But the above state of affairs is never realized since every body, when at a temperature above its surroundings, always loses heat by radiation, convection and conduction, except when placed in a vacuum, as the filament in the incandescent lamp, when it loses heat by radiation mostly, and a small amount by conduction along the lead-in wires which may be neglected.

If (A) is the surface area of the wire, and $T_1$ ($= 273\ t$) its temperature, while $T_2$ is the temperature of the surrounding objects, then the amount of heat radiated per second or the power radiated by the wire is according to Stephan's Law:

$P_r = KA\ (T_1^4 - T_2^4)$ ..... (4)

Where $P_r$ is expressed in watts. If $T_1$ does not differ greatly from $T_2$, as in the case of the hot wire ammeter (4) can be written:

$$P_r = KA\ (T_1 - T_2)\ (T_1^3 + T_1\ ^2T_2 + T_1\ T_2^2 + T_2^3)$$

or approximately

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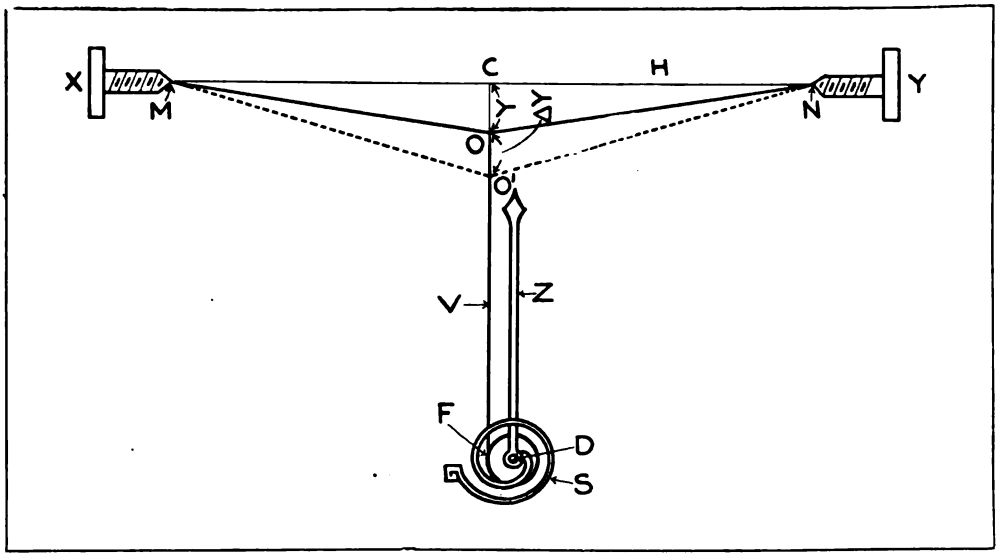


*Fig. 1*

$P_r = 4\ K\ A\ T^3\ (T_1 - T)$.....(5)
Where $(T_1 - T)$ is the difference of temperature between the temperature $(T_1)$ of the wire and (T) of its surroundings. Then it will be seen that for moderate temperature difference the power radiated is proportional to the temperature rise.

In air, the heat lost by the wire will be greater than that given in equation (5) due to the loss of heat by convection. But since the heat lost by convection is also approximately proportional to the temperature difference, if this is moderate (5) can still be used if the constant (K) is increased to $(K_1)$ which has a value for stationary air

$K_1 = 25 \times 10^{-12}$ to $50 \times 10^{-12}$

The temperature of the wire considered above will continue to increase until the power supplied is equal to the total power lost by radiation and convection, or when

$I^2R = 4\ K\ A\ T^3\ (T_1 - T)$
$= 4\ K\ A\ T^3t$.....(6)

where $t = (T_1 - T)$ = rise of temperature of the wire above its surroundings.

When the temperature of a wire is raised, its length is increased and this linear expansion or elongation is proportional to the rise of temperature (t), in fact:

$\triangle L = B\ t\ L$.....(7)

where (L) is the length of the wire and (B) the coefficient of linear expansion of the wire, which is defined as the elongation produced per unit length for a rise in temperature from 0° to 1° centigrade. For platinum, B = .0000088 which means that a platinum wire 1 centimeter long has its length increased by .0000088 cm. for 10° cent. rise in temperature.

Transposing equation (6), we have

$$t = \frac{I^2R}{4\ K\ A\ T^3} \quad \text{.....(8)}$$

Substituting this value of t in equation (7), we have

$$\triangle L = \frac{B\ L\ I^2R}{4\ K\ A\ T^3} \quad \text{.....(9)}$$

which is an approximate formula upon which the operating principle of the expanding hot wire ammeter is based.

It will be seen from equation (9) that if other things are constant, the increase in length $(\triangle L)$ of the wire is proportional to the square of the current, and therefore this property of the wire may be used to indicate the root mean square value of the oscillatory currents used in radio communication, if this wire be so mounted as to show by means of a pointer its elongation when the currents flow through it. Since the coefficient of linear expansion for most wires is very small, the elongation will also be small for moderate currents and therefore moderate rises in temperature of the wire.

It is, of course, evident from equation (9) that by increasing the length (L) of

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the wire ($\triangle$ L) will be larger for a given current, but this would require an instrument of large size, which is not desirable.

By using a very fine wire, we not only increase the resistance (R) but also at the same time decrease its surface (A), thereby making ($\triangle$ L) large. The resistance (R) can furthermore be increased by employing a wire having a high specific resistance. This specific resistance should not only be large, but it must be practically constant for such changes in temperature as are encountered in the use of the wire as a current indicator; otherwise, the accuracy of the instrument will be impaired. A wire made of a pure metal is rarely used on account of its large temperature coefficient of resistance; this is nearly .004 per degree centigrade. That is, the resistance of the wire increases by this amount when subject to one degree rise of temperature. But there are alloys, such as German silver, constantan, and manganin, which have a much smaller temperature coefficient.

An excellent material for hot wire ammeters is "Therlo," which is an alloy of copper, manganese and aluminum. Its temperature coefficient is very small and practically constant, while its expansion coefficient, as proven by experiment, is quite constant.

Platinum-silver has been used in the Cardew hot wire voltmeter.

Even after taking all the measures mentioned to make ($\triangle$ L) as large as possible, it is still so small as to necessitate some arrangement for magnifying this elongation. The method generally adopted for effecting this magnification in the hot wire ammeter used for measuring high frequency currents is outlined in Fig. 1.

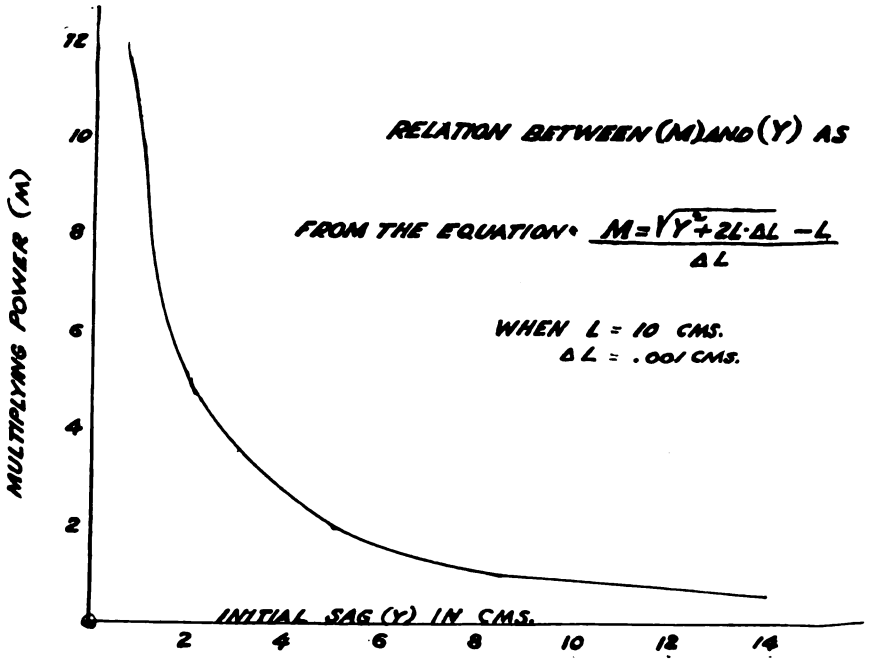


*Fig. 2*

The extremities of the wire (MON), through which the currents to be measured pass, are fastened to the screws (X) and (Y) which are mounted on insulating supports. To the center of the wire, one end of a silk thread is fastened while the other end passes around the drum (F). The drum and the pointer (Z) are fixed to a spindle (D) which turns in jeweled bearings to diminish friction. The spiral spring (S) serves to keep the silk thread (V) and wire (MON) taut, by tending to wind the

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thread upon the drum (F). If now a current passes through the wire, its temperature will be raised, and therefore it will expand. The center (O) will sag, thereby allowing the spring (S) to turn the drum and move the pointer over the scale.

A small expansion ($\triangle$ L) of the wire will produce a much larger displacement ($\triangle$ Y) of the cente rof the wire. But let us see what the actual multiplying power of this arrangement is, and what should be the initial sag (Y) to obtain the best results.

Let the semi-length (ON) of the wire be represented by (L), and the initial sag of the wire by (Y). Let (H) represent the distance (CN). If now a current be sent through the wire, (L) will increase to (L + $\triangle$ L), and (Y) to (Y + $\triangle$ Y), or the whole wire (2L) will increase in length by (2 $\triangle$ L). Since (C O N) and (C O' N) are right triangles, we have

$$H^2 = \overline{ON}^2 - \overline{OC}^2 = L^2 - Y^2$$

And $H^2 = O^1N^2 - \overline{O^1C}^2$

$$= (L + \triangle L)^2 - (Y + \triangle Y)^2$$

or $$L^2 - Y^2 = (L + \triangle L)^2 - (Y + \triangle Y)^2$$

transporting $$(Y + \triangle Y)^2 = (L + \triangle L)^2 - L^2 + Y^2$$

Solving for ($\triangle$ Y), we have

$$\triangle Y = \sqrt{Y^2 + 2L \triangle L + \triangle L^2} - Y$$

and

$$\frac{\triangle Y}{\triangle L} = M = \frac{\sqrt{Y^2 + 2L \triangle L + \overline{\triangle L}^2} - Y}{\triangle L}$$

Where (M) is the multiplying power of the sagging wire arrangement. ($\triangle$ L) is usually so small that its square may be neglected in comparison with (2L $\triangle$ L). We therefore have

$$M = \frac{\sqrt{Y^2 + 2L \triangle L} - Y}{\triangle L}$$

Now it can be shown that the larger (Y) is, the smaller (M) will be, for a given expansion ($\triangle$ L) of the wire, and conversely the smaller (Y) is, the greater (M) will be. This means that the straighter the wire (MON), the more sensitive the instrument.

The relation between (M) and (Y) is shown graphically in Fig. 2.

In the limit when (Y) is zero, we have

$$M = \sqrt{\frac{2L \triangle L}{\triangle L}} = \sqrt{\frac{2L}{\triangle L}}$$

from which it is evident that (M) would be extremely great for very small expansions of the wire, that is for small currents.

From the foregoing considerations it is seen that this arrangement has different multiplying powers for currents of different strengths. Equation (9) shows that the increase in length of the wire is proportional to the square of the current, that is, the length increases more rapidly than the current, while the multiplying power diminishes with an increase of current, and thus tends to some extent to make the deflection of the needle, a linear function of the current.

The multiplying power of the instrument can be still further increased if the lower end of the thread (V) be fixed to a rigid support, while one end of a second thread is fastened to the center of (V), the other end passing around the drum (F), which now occupies a position to the right or left of (V). A small sag in the wire (MON) produces a much larger sag in (V), thereby giving a much larger deflection of the needle.

By making the drum (F) quite small and the needle fairly long, the multiplying power is still further increased in the ratio of the length of the needle to the radius of the drum.

Supposing the average multiplying power obtained by utilizing the sag produced in the wire by an expansion is 10, while the multiplying power of the thread (V) is 5, and the ratio of the length of the needle to the radius of the drum is 40, then the total multiplying power is

$$10 \times 5 \times 40 = 2{,}000.$$

That is, if the wire expands by .001 in. due to a certain current, the total displacement of the end of the pointer will be .001 $\times$ 2000 or 2 inches.

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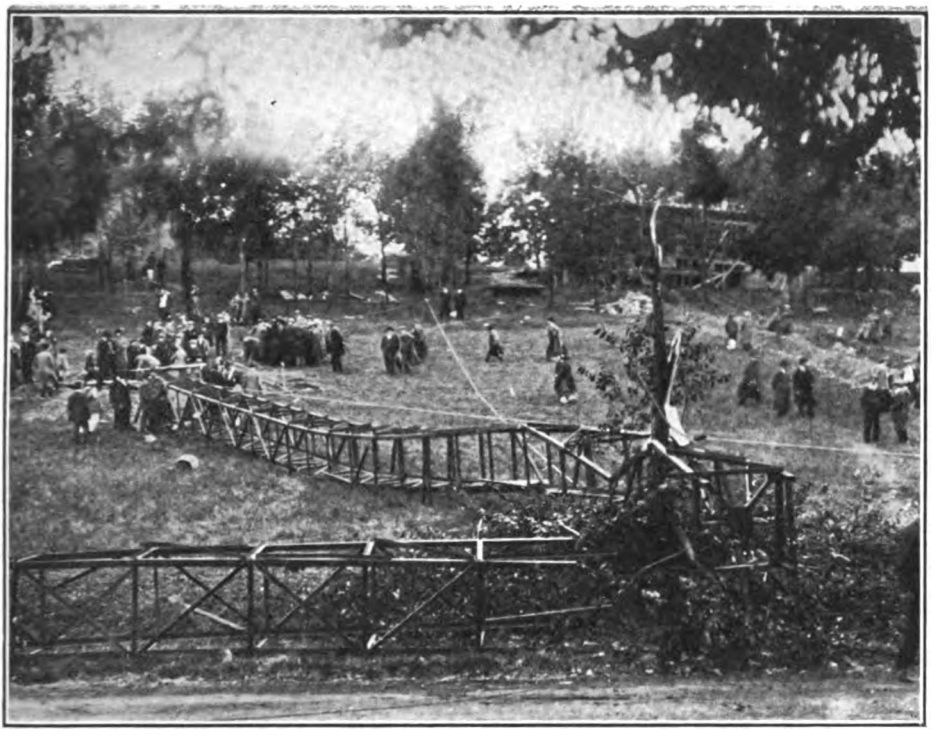

*Wreck of the 304-foot wireless tower at Tufts College*

## TUFTS' TOWER ALMOST WRECKED TRAIN

As reported in the October issue, on Sunday September 26, during a terrific gale the new 304-foot wireless tower at Tufts College, Mass., was blown over, a section landing in front of an express train speeding 40 miles an hour.

The quick wit of the engineer in throwing on the brakes prevented a serious accident; as it was, the cow catcher was tangled up with a mess of steel girders and it took hours to clear the track.

The new tower was nearly completed and it was hoped through it communication would be established with Europe. A new tower will replace the old one in a short time.

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## WIRELESS INSTEAD OF CABLE

A Washington correspondent says that because of numerous complaints made by American exporters and importers against censorship delays of commercial cable messages in London and the inability of the United States government to effect relief, the State Department is about to advise these firms to use the wireless instead of cable. The principal protests have concerned the detention of commercial messages of American firms to and from Norway, Sweden, Denmark and Holland.

*Locomotive stopped just in time to avoid an accident*

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M. E. Packman presented a paper on "The Training of the Radio Operator," at a recent meeting of The Institute of Radio Engineers.



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# How to Conduct a Radio Club

## Specially Prepared for the National Amateur Wireless Association

By Elmer E. Bucher

Article XVIII

THE resonance curve of a radio transmitter is a graphic equation showing the relation between current amplitude and frequency or wave-length at points on and off the fundamental frequency. The value of the plotting lies in the fact that it enables the experimenter to obtain, in a general way, the over-all distribution of energy in the emitted wave, the decrement of damping and the relative current amplitude in the two wave-lengths, if present.

To plot the resonance curve of a radio transmitter, a wave-meter is required in series with which is connected either a hot wire milliammeter or a hot wire milliwattmeter. The milliammeter should have a range of, say, forty to 240 milliamperes, while the wattmeter may have a scale reading of .01 to .1 watt. The latter instrument is preferably connected to the secondary winding of a step-down transformer, the primary winding of which is connected in series with the circuit to the wave-meter. This transformer, as a rule, is made up of Litzendraht wire, the primary consisting of ten turns wound on a wooden spool, about 1½ inches in length by 1 inch in diameter. The secondary winding consists of five turns of the same wire wound directly over it with a single layer of empire cloth between.

The wattmeter having been connected accordingly, a few preliminary determinations are made in order that the proper inductive relation between the coil of the wave-meter and the antenna circuit may be found. Care must be taken that the wattmeter is not burned out at the point of resonance. The proper inductive relation having been obtained by trial, the coil of the wave-meter is placed in such position as to give a near maximum scale deflection of the wattmeter at the peak of resonance for the longer wave. If the maximum deflection of the wattmeter is obtained at resonance, it is evident that there will be a decrease of current at wave-lengths off resonance, the reduction being dependent upon the decrement of the circuit.

Readings of the indicating instrument having been observed at resonance, corresponding readings are begun off resonance at a point where the indicating instrument shows a small scale deflection, say, .01 watt. Similar observations are made at other wave-lengths approaching resonance and beyond resonance until a full set of values is observed; that is to say, the readings are continued to a point beyond resonance where a nearly zero deflection of the wattmeter is obtained.

A diagram of connections and the relative positions of the apparatus for this determination are shown in Fig. 1, where the closed oscillatory circuit of an amateur radio transmitter is represented by the primary winding, L, the high potential condenser, C, and the spark gap, S. The antenna system includes the secondary winding, L-1, the aerial tuning inductance, L-2, and the earth wire, L-3, which preferably has a single turn inserted series. The coil of the wave-meter, L-4, is placed in inductive relation to L-3 and is in series with the primary winding of the step-down transformer, T, and the variable



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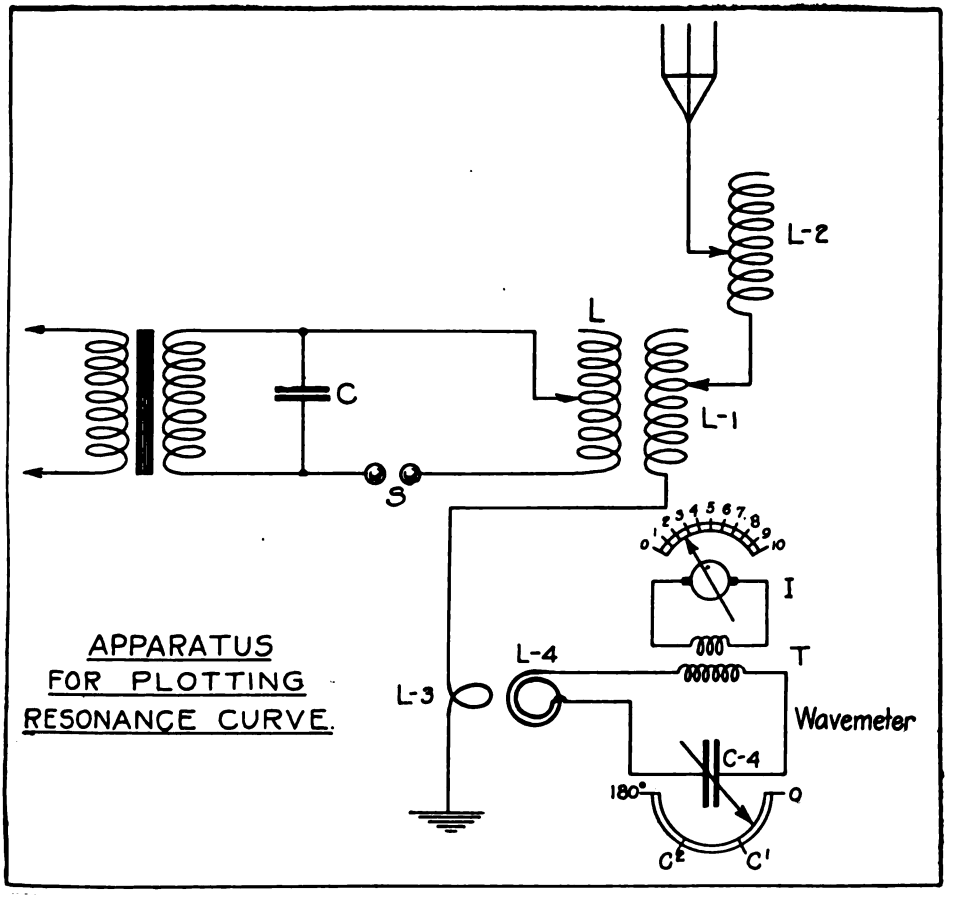


*Fig. 1*

condenser, C-4. The wattmeter is indicated at I.

Assume, for example, that the spark gap, S, is discharging and that the closed and open oscillatory circuits are in exact resonance; furthermore, that the points, C-1 and C-2, on the variable condenser, C-4, are the peaks of resonance in the double wave. Then, as the pointer of the variable condenser is moved from zero position toward C-1, the reading of the wattmeter increases, until the point, C-1, is passed, when a decrease takes place. An increase of current again takes place as C-2 is approached, followed by a decrease when the peak of resonance is passed. If the setting of wave-length for the wave-meter is noted and the corresponding deflection of the hot wire wattmeter observed, the data thus obtained may be plotted in the form of a resonance curve in the following manner (see Fig. 2):

Placing in one column the value of wave-lengths corresponding to the condenser scale of the wave-meter, and in the second column the corresponding deflection of the hot wire wattmeter, co-ordinate points are laid off on cross-section paper through which a common line or curve is drawn. A typical set of readings follows:

| Wave-length of the wave-meter | Corresponding deflection of the hot wire wattmeter |
|---|---|
| 250 | .02 |
| 255 | .034 |
| 260 | .038 |
| 265 | .037 |
| 270 | .034 |
| 275 | .032 |
| 280 | .033 |

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| | |
|---|---|
| 285 | .035 |
| 290 | .05 |
| 295 | .09 |
| 300 | .1 |
| 305 | .08 |
| 310 | .05 |
| 315 | .03 |
| 320 | .02 |
| 325 | .013 |

With the cross section paper before us, the wave-length readings are laid off horizontally as indicated in Fig. 2 and are known as the abscissas of the points on the curve, while the hot wire wattmeter readings are laid out vertically and are known as the ordinates of the points in the curve. Take, for example, the wave-length of 290 meters; the corresponding hot wire wattmeter deflection is .05. Then follow the vertical line corresponding to 290 to that point where the horizontal line is met corresponding to .05 and place a dot or a cross, as indicated. Proceed in a similar manner throughout the entire set of readings until a complete set of points for the curve are located. Then draw a line joining them.

Now, if the coil, L-4, of the wave-meter is allowed to remain in the same position to the coil, L-3, and various degrees of coupling are employed between the primary and secondary winding of the oscillation transformer, L and L-1, the curve in Fig. 2 will become sharper or broader, accordingly, as the coupling is decreased or increased. In this manner a comparison may be made of the relative sharpness of emitted waves, allowing to some extent a predetermination of the amount of interference to be expected. If the coupling between L and L-1 is sufficiently decreased, the lower peak of resonance, which in the curve exists at about 260 meters, may completely disappear and a single sharp maximum peak result. The resonance curve shown in Fig. 2 is not that of a "pure" wave in compliance with the United States restrictions. To be considered as such the energy in the lesser wave must not exceed ten per cent. of that in the greater.

Should the wave-meter indicate no sharp or defined peak of resonance, it may be that an excessive value of coupling is in use between L and L-1, or that high resistance joints or poor connections exist in the antenna circuit. Again, this may be due to leakage of the insulators; the remedy, of course, is obvious.

From the curve given in Fig. 2 we can estimate the damping of the emitted wave using the formula:

$$\delta_1 + \delta_2 = \frac{\lambda_r - \lambda}{\lambda} 2\pi$$

where $\lambda_r$ = the wave-length of the wave-meter at resonance.

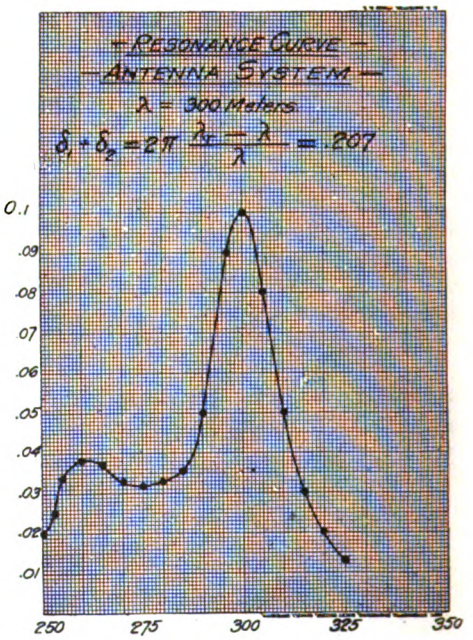


*Fig. 2*

$\lambda$ = the wave-length of the wave-meter at a point off resonance where the current in the wattmeter is one-half of that indicated at $\lambda_r$.

$\delta_2$ = the decrement of the wave-meter.

If $\delta_2$ is known, we can subtract its value from the sum of $\delta_1 + \delta_2$, leaving the value of $\delta_1$ the circuit under measurement.

If the abscissas of the points in the curve represent capacity values of the

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wave-meter condenser, and furthermore, the curve is not symmetrical on either side of the slope, we may then take a mean value as per the following formula:

$$\delta_1 + \delta_2 = \frac{\pi}{2} \times \frac{C_a - C_b}{C_r}$$

where $C_a$ = the capacity of the wave-meter condenser at a point above resonance where the reading of the wattmeter equals one-half of that at resonance or $C_r$.

where $C_b$ = the condenser capacity at a similar point below resonance.

and $C_r$ = the capacity of the condenser at resonance where the maximum scale deflection of the wattmeter is obtained.

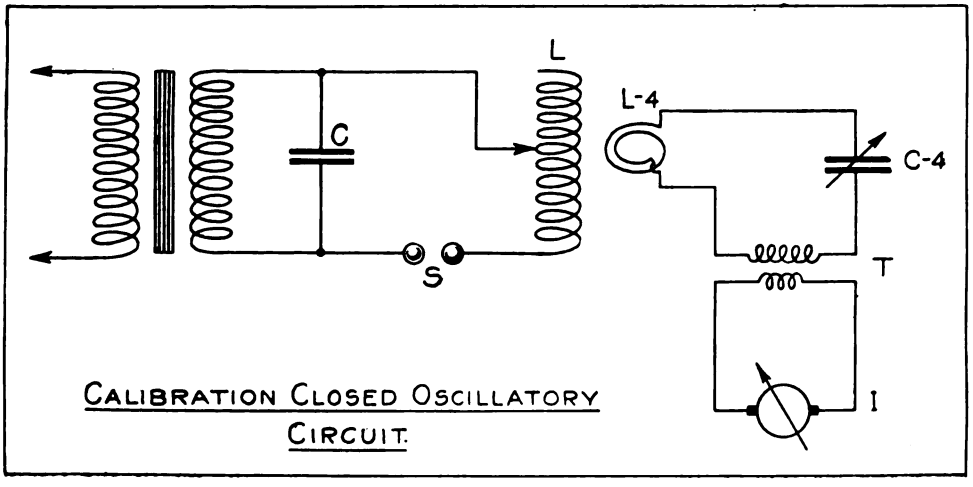
Again, the values of $\delta_2$ being known, we may subtract it from the value of $\delta_1 + \delta_2$ to obtain the value of $\delta_1$, the decrement of the circuit under measurement.

Using the same apparatus as that employed for plotting a resonance curve, the amateur experimenter may obtain other curves indicating the wave-length of the open and closed oscillatory circuits with various turns of inductance in use at the primary and secondary windings. For example, if it is desired to determine the increase in wave-length by the addition of turns in the closed circuit, the apparatus is set up as shown in Fig. 3. The coil of the wave-meter, L-4, is placed in close inductive relation to L, but not too close to burn out the wattmeter, I. Starting with one turn in the closed circuit, the corresponding wave-length is read on the wave-meter at the point where the maximum deflection of the wattmeter is obtained (with spark, of course, discharging). Turns are then added progressively at L throughout the series until a full set of readings is obtained. A typical case follows:

| Turns | Corresponding Wave-Lengths |
|---|---|
| 1 | 100 |
| 2 | 145 |
| 3 | 200 |
| 4 | 242 |
| 5 | 295 |
| 6 | 345 |
| 7 | 395 |

Plotted in curve form these data appear as at curve A in Fig. 4. Here the wave-lengths in meters are the abscissas of the points on the curve and the helix turns the ordinates of the points on the curve. The corresponding wave-lengths between complete turns on the helix can be calculated readily by following the abscissas to the base line or the horizontal axis.

We can plot the readings for the




CALIBRATION CLOSED OSCILLATORY CIRCUIT.

*Fig. 3*

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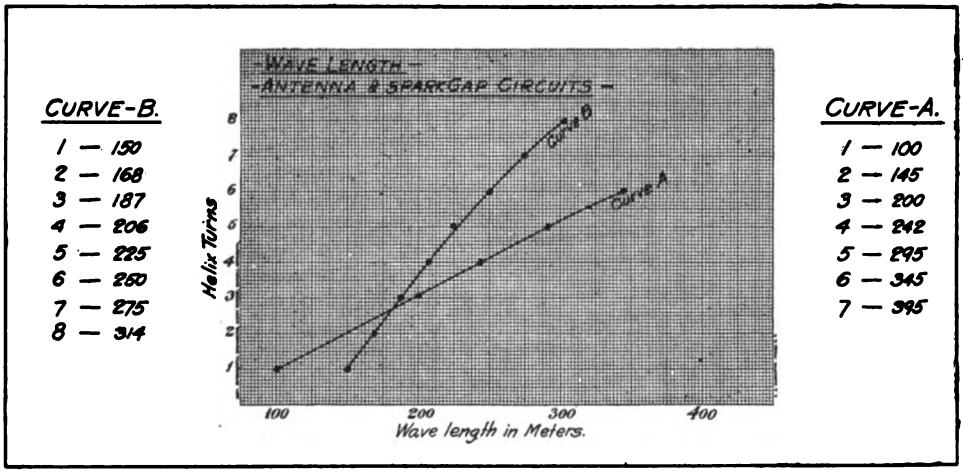


*Fig. 4*

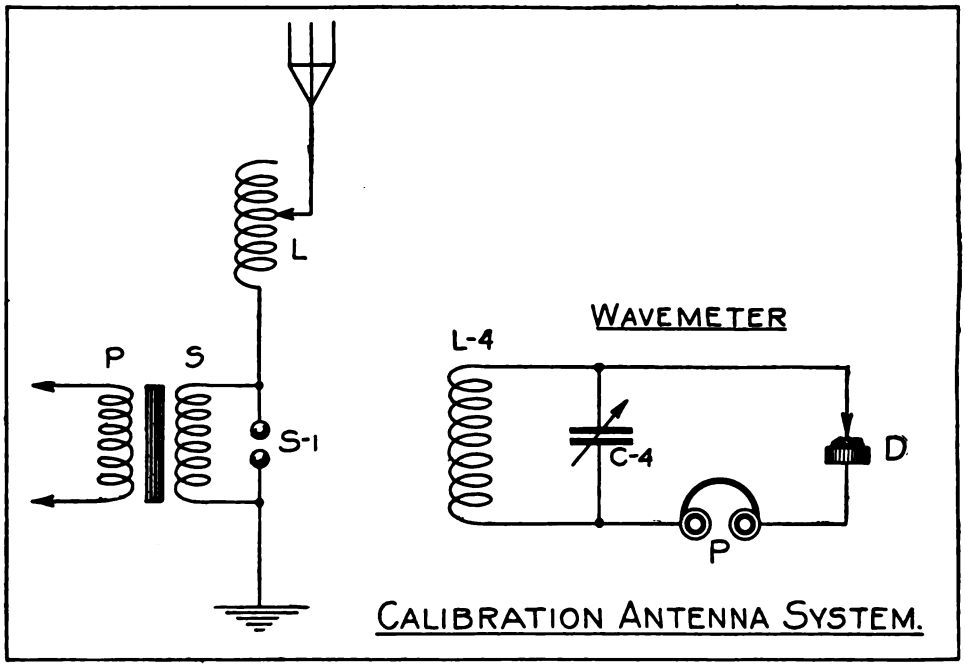


*Fig. 5*

open circuit of a transmitting system in a similar way, but in this case a spark gap must be connected in series with the antenna system and in turn connected to the secondary winding of an induction coil. Generally the energy flowing in the antenna circuit is insufficient with this connection to operate the wattmeter, or, in any event, the spark discharge is too irregular to permit a reading of the wattmeter to be observed. It is therefore preferable to shunt the wave-meter by a crystalline detector and head telephone, the point of resonance being located by the maximum sound in the receiver. A diagram of connections for obtainng this reading is given in Fig. 5. Here the secondary winding of the oscillation transformer is represented at L

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and has a variable tap-off. The spark gap in series is indicated at S-1, the primary and secondary windings of the induction coil at P and S. The wave-meter, L-4, C-4, is shunted by the crystalline detector, D, connected in series with the head telephone, P. Various turns are added in the circuit at L and corresponding wave-length readings made on the wave-meter. A typical set of readings follows:

| Turns | Corresponding Wave-Lengths in Meters |
|---|---|
| 1 | 150 |
| 2 | 168 |
| 3 | 187 |
| 4 | 206 |
| 5 | 225 |
| 6 | 250 |
| 7 | 275 |
| 8 | 314 |

These data appear in the curve, B, on Fig. 4 and intermediate values lying between the complete turns may be taken as in the previous case.

It is recommended that curves of the latter type be prepared at each amateur station and posted in the apparatus room for quick reference. In this manner the wave-length of the open and closed oscillatory circuits may be quickly changed, with the assurance that the two circuits are in exact resonance. Of course, the emitted wave is somewhat altered in length as the coupling between the primary and secondary windings is changed. Therefore at each standard wave-length various degrees of coupling should be tried out, until the one most suitable for local conditions of interference and effectiveness is determined. A wattmeter suitable for the foregoing measurements is briefly described on page 925 of the September, 1915, issue of THE WIRELESS AGE.

A method for eliminating the decrement of the wave-meter is fully described in the book "How to Conduct a Radio Club." This volume can be obtained by enrolling as a charter member of the National Amateur Wireless Association.

*(To be continued)*

## NEW TAHITI STATION

The United States Bureau of Navigation announces that the wireless station now being built by the French government on Tahiti Island, Society Islands, will be ready to receive and transmit commercial messages before the close of 1915.

The temporary station now in course of erection will be followed by a much more powerful plant. The plans of the temporary station contemplate a 10-kilowatt installation of the type used by the French government, with a wave-length of 600 meters. The towers, two in number, will be 100 meters in height. The station will be expected to reach Awanui, New Zealand; Suva, Fiji; and the Samoan Islands.

Immediately upon the completion of the temporary station work will begin on the permanent station. This permanent 300-kilowatt station will be operated by a 500-horsepower gasoline engine, and will use a wave-length of 2,500 meters. There will be eight towers, each 100 meters high, erected in parallel rows of four towers. The space between the towers will be 250 meters, and 200 meters between parallels. There will be two antennæ, one of 600 meters wave-length, the other of 2,500 meters.

With the permanent station it is expected that communication will be established with stations in Cochin-China, South America; Honolulu, Hawaii; San Francisco, Cal.; Sydney, Australia, and even in Martinique and Guadaloupe, West Indies. All material used in the construction of these stations is supplied by the French government and is shipped from France.

Call letters have not been assigned to the station and rates are not obtained at the present time.

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Dr. Filippo de Filippi, Italian explorer, in a lecture recently delivered before the Royal Geographical Society at Bombay, on his expedition to the Karakorum and Central Asia, related how he had determined longitude by means of wireless time signals transmitted from Lahore.

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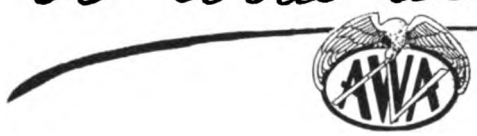
# A Word with You




THIS is to be considered a personal talk in which I wish first to thank in person the many amateurs who have so promptly responded to the invitation to become associated with our nation-wide organization. It is certainly very gratifying to have received hundreds of applications for membership within the elapsed period of less than two weeks since our first announcement appeared. And the fact that our membership dues are reckoned in dollars, rather than cents, as all previous amateur organizations have been, speaks eloquently to me of the appreciation of our efforts to really DO something for you ambitious and energetic experimenters. I know that in a great many cases considerable sacrifices have been made to secure this money, and the fact that I am now addressing hundreds of fellow members who have had, of necessity, to very carefully weigh the merits of the project, spurs me on to renewed effort to make the *big* men of the country take an interest in your affairs which shall equal that which I already feel. It would have been a great pleasure to all concerned in the establishment of the National Amateur Wireless Association if the necessary equipment could have been supplied gratis; this, however, was out of the question and we had to resort to the next best thing: placing the equipment on an actual cost basis. From the letters which are pouring into headquarters every day I know all our members are pleased; and that is ample reward for the labor without compensation which was required of the half dozen experts who collaborated in the creation of this serviceable material. And it is a great pleasure to record that I have already seen marked indications that you, as fellow members, appreciate that nowhere outside this organization could services of equal value be secured so economically.

That the National Amateur Wireless Association will have imitators is confidently expected; that our carefully worked out plans will be copied, modified, twisted and turned to serve someone's ends or gratify another's vanities, is something we anticipated long before the organization was launched. But the emblem and membership certificate you now hold means, and will continue to mean, more than an empty symbol. Conducting an orgaziation of national service to amateurs requires—even with the unusually favorable facilities at our command—membership fees at least equal to ours. I feel that this financial discussion is required in explanation in these early days of our existence. As Americans of intelligence, you will be the first to appreciate that what is given for nothing is usually worth just that.

With so many men of high scientific position associated with us in official capacities this association should mean a great deal to those who purpose making radio communication a lifetime work; the National Amateur Wireless Association not only hopes to standardize progressive instructional steps for the amateur but assist those who qualify to enter the

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field professionally. Neither myself nor my associates are particularly interested in the dawdler who looks upon his wireless set as a pleasing plaything; we seek rather for better acquaintance with the many young men who are sufficiently interested in the experiments they are conducting to want to know why certain elements in combination accomplish certain results, not merely that these things happen. This does not mean that we have no interest in the beginner; on the contrary, we wish particularly to cultivate those who are just entering the amateur ranks. One of our most cherished desires is to place the newcomer in the proper environment, to have him associate with whatever club in his town or city is best qualified to instruct him along the proper lines, and to co-operate with that club in making its meetings so interesting that the beginner will apply himself diligently to the task of acquiring knowledge which will place him alongside the more advanced members. Through the delegate that each club securing recognition from the National Amateur Wireless Association elects to the National Council, we expect to learn just what are the definite problems that hinder progress and to deal with the cases in a broad way.

THE preparedness features of our program already outlined to you are ones we must not neglect in our anxiety to be of service to ourselves as individuals. A few nights ago I had the great privilege of dining with Frederick Palmer and listening to a talk on war conditions as he saw them. Mr. Palmer, as you probably know, is the war correspondent selected to represent the entire American press and the one newspaper man who spent a full year on the firing line in the great conflict raging abroad. What he said of our perilous situation is indelibly impressed on my mind. Never before have I so fully appreciated that where fighting forces are short of both equipment and training, they may be mowed down like wheat before the scythe, wiped out in battalions in the twinkling of an eye. That great personal courage is of little avail in modern warfare has never before been so graphically and horribly demonstrated; it is a war of iron machines spitting deadly fire and human machines burrowing in trenches. Brilliant charges and hand to hand conflict in the open is practically unknown—organization wins the victory, organization of heavy artillery equipment, vast quantities of supplies and ammunition brought forward with clockwork precision, and tens of thousands of men acting as one. As Mr. Palmer expressed it, it is a war of engineers.

WHAT would this country come to if we were invaded in our present state of unpreparedness! Have you ever stopped to think what war means? You know in a general way that the Navy's recent "war games" off the Atlantic coast have resulted in the defending vessels being "sunk" or put out of action and the "invaders" having things pretty much their own way. You know something of the naval appropriation bills that are now coming up before Congress. In a phrase, you know that with our present navy an attacking power would have little difficulty in landing on American soil. The army then must save us? In theory, yes; but in practice it would not have a chance.

Most of us accept the unthinking attitude which considers raising a million men over night; many of us—particularly those who can trace lineal descent from Revolutionary fighters—believe the American civilian,

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once aroused, the greatest natural warrior in the universe. For a long time I felt that way about it myself. The fact that as a nation we have never been whipped, that wonderfully effective armies have been created out of raw material and have repelled strong invaders, has given us a false sense of security that is dangerous beyond expression. As one good American has phrased it, our young grow up believing that each of us can lick ten men of any other country. The boy leaves school with the idea that all he has to do is to grab a rifle and march to victory, that we can lock arms with each other and just push the enemy into the sea; and in a pinch, the Lord, or Edison, will save us. Blatant pacificism has so flattered our vanity that we have not taken the small effort necessary to see what lies spread before our very eyes.

THE army we are expected to depend upon is smaller than the army of Montenegro, a toy-country. It could not possibly defend all its forts, for it has less than one hour's supply of ammunition for coast defense guns. We picture it going valiantly into battle, never considering that the entire mobile force on the United States proper is scarcely more than twice the size of the New York police force, and has ammunition supplies that would be exhausted in three or four days of fighting.

A telegraphed summary of the text of President Wilson's annual message to Congress has come to my desk just as this is written. The strongest recommendations embodied in the document have to do with comprehensive plans for strengthening the national defenses, because: "The European war has extended its threatening and sinister scope until it has swept into its flame some portion of every quarter of the globe, not excepting our own hemisphere; has altered the whole face of international affairs, and now presents a prospect of reorganization and reconstruction such as statesmen and peoples have never been called upon to attempt before."

The passion of the American people, the President declared, was for peace; that conquest and dominion was not in their reckoning nor agreeable to their principles. "But just because we demand unmolested development and the undisturbed government of our own lives upon our own principles of right and liberty," he said, "we resent, from whatever quarter it may come, the aggression we ourselves will not practice. We insist upon security in prosecuting our self-chosen lines of national development. We do more than that. We demand it also for others."

War, the President declared, was regarded by the United States merely as a means of asserting the rights of a people against aggression, and that "we are as fiercely jealous of coercive or dictatorial power within our own nation as from aggression from without." He said the nation would not maintain a standing army except for uses which are as necessary in times of peace as in times of war, but that the country did believe in a body of free citizens ready and sufficient to take care of themselves and of the Government. "But war has never been a mere matter of men and arms," he continued. "It is a thing of disciplined might. If our citizens are ever to fight effectively upon a sudden summons, they must know how modern fighting is done, and what to do when the summons comes to render themselves immediately available and immediately effective. And the Government must be their servant in this matter; must supply them with the training they need to take care of themselves and of it. The military arm of their Government, which they will not allow to

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direct them, they may properly use to serve them and make their independence secure—and not their own independence merely, but the rights also of those with whom they have made common cause, should they also be put in jeopardy."

The President presented the War Department plans for strengthening the army as "the essential first step" and "for the present" sufficient. The plans include the increasing of the standing army to a force of 141,843 men of all services, and the establishment of a supplementary force of 400,000 disciplined citizens, who would undergo training for short periods, throughout three years of a six years' enlistment. "It would depend upon the patriotic feeling of the younger men of the country whether they responded to such a call to service or not," said the President.

There can be little question that the response will merit the confidence the leader of the Nation has publicly expressed on many occasions when referring to the patriotism of our young men.

The new army and the proposed National Reserve will not insure victory should war be declared on us to-morrow. But it is a step in the right direction and may aid in eventually securing the 400,000 *trained regulars* we need to back up our volunteer forces.

NOW a word or two as to what the National Amateur Wireless Association expects from you. In the land warfare which history records the cavalry has always been considered the eye of the army. Nowadays an army is more concerned in determining the exact range for its artillery than in ascertaining the details of possible infantry charges on its flanks. Trench warfare means ceaseless firing of rifles and machine guns from covered positions, constant shelling from concealed batteries. Positions are usually taken only after the enemy entrenchments have been battered to pieces; consequently it is of the greatest importance for a commander to learn the location of enemy guns and the layout scheme of the opposing redoubts. In former days one of the most important missions of the cavalry was to conduct the reconnaissance, it was sent out to bring back word of the number of men opposing and their distribution. The new method of fighting has changed all this. As I have had it described to me by men who have actually walked along occupied trenches, there is absolutely no telling the number of the occupants—or even that they are occupied—until you are right upon them. Cavalry sent forth on this particular mission would be wiped out in an instant on the present battlefields in France.

Reporting the advance of enemy reinforcements brought up from the rear is also no longer the simple task it used to be. Thousands of men are now brought forward to the firing line in underground passages extending back as much as five miles from the actual scene of hostilities; they do not march along smooth highways with fifes screaming and banners flying.

The cavalry still has its uses and they are many, but the change just mentioned is indicative of the increasing importance of the branches of military service that are of such special concern to the members of the National Amateur Wireless Association.

IT is difficult almost to the degree of impossibility to learn exactly how wireless is being employed in the present fighting. But a few scattered bits of information given publicly and pieced together throw a little light on our needs in this connection.

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The famous inventor, Marconi, president of your Association, said in a recent interview given to the Giornal d'Italia that while the war continued he could not enumerate the advantages obtained with wireless, but it was not a secret that with a small wireless apparatus aeroplanes could now communicate with headquarters without landing—indeed, could remain in the enemy's zone and continue their scouting operations while still in touch with their own army.

The extent to which the wireless equipped aeroplane has been developed by France is looked upon as one of the most remarkable developments of the war. The French air fleets have been organized and drilled as thoroughly as fleets of the sea; aerial tactics are being studied as carefully as any other form of strategy. Every day less is heard about smoke bombs signaling from aircraft to locate artillery fire, but practically nothing definite has been said about the increase in wireless signaling. Yet in the words of one of our greatest war correspondents in France we are told that an "officer got out one of the machines and exhibited its tricks and its wireless apparatus." And from the same source it is learned that an army consisting of eight corps has fifty-four of these aeroplanes, to which this significant remark is added: "I am speaking now of the particular type of aeroplane employed for regulating artillery fire."

John Hays Hammond, Jr., who has just returned from the other side, is now advocating, as part of the American defense program, the acquisition of 2,000 air scouting machines for land forces alone. Henry A. Wise Wood has begun an agitation through the Aero Club of America to establish a chain of aero-radio stations at intervals of 100 miles along our coasts. His plan embraces aeroplanes patroling a circle of 100 miles in diameter and reporting by wireless every hour to a base on shore. Two hundred wireless equipped aeroplanes would thus protect America from surprises by sea.

From all viewpoints, aircraft fitted with wireless appears absolutely essential. Whether 200 will do, or 2,000 will be needed, I am not prepared to say. The recommendation of the Department of War which the President endorses provides for four aero squadrons. Incidentally the present aerial equipment of our army reaches the grand total of ten machines. The navy is just as badly off—and this is the land in which the aeroplane was born!

SOME day we will know what the horrors of warfare really mean. It may be years off, but there is little question that this country will eventually come to grips with some other nation. And it is equally safe to predict that we will not be prepared. The defense of the nation will, as in the past, fall on the shoulders of the volunteer.

There is only one quick way to wake up the nation; that is for the people themselves to wake up. The heroism of the American volunteer is traditional, his behavior under fire has been written brilliantly in the annals of the wars of the past. But organization when war is upon us means the useless sacrifice of thousands of young men, the flower of the nation, as it were, snuffed out of existence because we are now blind to our peril, too cocksure that we'll be ready when the time comes. Our geographical problems are enormous, the very size of our country multiplies our difficulties beyond those that other nations have to face. And yet we placidly contemplate taking the field a million patriots strong at the

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sound of the first gun fired. Where are we going to get officers who know enough about this modern, highly specialized business of fighting to direct this theoretical army?

According to military authorities the world over, a soldier who has had less than a year's training is useless in battle; even with the equipment at hand our volunteers would be pitifully inadequate until they had undergone the experience that makes trained soldiers.

Unmistakably, the solution lies with you. You may lie back in fancied security, or you may prepare.

IF war comes wireless operators will be needed—a great many wireless operators. Up to now you have probably considered the navy's problems only; it is natural to link up any thought of wireless with the sea, and we hear the naval appropriation more frequently discussed in public. But so far as the amateur wireless man goes, the sea forces don't need him, don't want him. If there is one thing the most useless in this universe of ours it is an untrained man aboard a fighting vessel. Those among you who are ready to consider a war time career in charge of a battleship set had better see the recruiting officer right now. As an enlisted man the navy will welcome you, will treat you famously in time of peace as well as war, but as a volunteer when war arrives—well, you would simply be in the way. No, if you are going to get ready to serve as a volunteer, turn your thoughts to coast defense and the land forces, learn something of military strategy, do actual field communication under the conditions which would apply in time of war and, above all things, strive for mastery of the code and a technical understanding of efficient apparatus.

You can't do this alone, you can't do it as a loosely governed radio club. But there are some among you who have spirit enough to get a wireless corps together, others who have had militia experience and are willing to serve as instructors. Somewhere in this country an amateur is going to start something, to blaze the trail for others to follow. The general public has long looked upon the amateur as a nuisance; someone is going to change that opinion and show what can be done in the way of elementary training of defense units. The radio signal corps, as a distinct and highly specialized branch of the service, can easily set the pace in civilian preparedness.

LET me show you the cumulative effect of concerted action on the part of amateurs. A wireless corps is organized somewhere to-morrow, we will say. The members, all boys between the ages of 12 and 18, affiliate with a local battalion of the Junior American Guard or some similar organization and faithfully attend the weekly drill and the summer encampment; they learn what military discipline means, accustom themselves to the rigors of camping and forced marches, perfect themselves in the operation of portable wireless equipment and become trained soldiers in embryo. Others then follow this example and signal corps are formed all over the country. These finally attain such proportions that they are given the opportunity of participating in parades and reviews in large cities. What will be the effect on the sidewalk spectator? Don't you think that he will then begin to realize his shortcomings and take action of some kind, either consider service in the militia for himself, or come to

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a realization that the handicaps placed on our paid defensive forces should be removed and these brought up to, at least, the safety point?

Assume now that a period of years has elapsed and the boys of the original corps have grown into manhood. Some of them still remain as military signaling instructors and are training the younger generation. Others have decided that the elementary training has been beneficial and they would like to continue it, for reasons of health, patriotism and recreation; they have gone into the militia and are devoting one night a week to drilling and studying the higher branches of training. Through sheer force of numbers and purpose these men have made the radio signaling corps what it is not today: a properly equipped, dependable branch of service, composed of *trained men* and ready for any emergency. That the regular army would then bring its radio divisions up to the proper standard is certain; seeing the militia well equipped, the people would demand that the regulars be even better provided for. And once we are properly organized in one branch there is hope that the American defensive program will permit proper organization throughout both land and sea forces. The conditions that exist today should certainly not be tolerated longer.

THINK over this matter of preparedness carefully. When you get ready to take up the matter seriously, have determined that you will not only start your signal corps but will continue it with faithful attendance at all drills for at least one year, let your Association know that you have secured a competent instructor and are ready to organize. When a sufficient number of such communications have been received the details will be worked out to fit all cases.

That is all for the present. The next step is up to you.

*Acting President.*

The eyes of many are blinded to fact and their minds closed to reason by an abhorrence of what they term "militarism," without any actual conception of just what this means or how it should affect the proper consideration of the subject. Those who really fear militarism, or, more accurately stated, those who dread real militarism, should be the strongest advocates of reasonable preparation. The latter is the preventive of militarism. If they unwisely defeat reasonable preparedness, they leave the country in a condition where the inevitable result of defeat, humiliation or acute apprehension will be hasty and ill-advised provisions as to armament far beyond anything which calm reason and wise provision would deem necessary.—From the annual report of Secretary of War Garrison.

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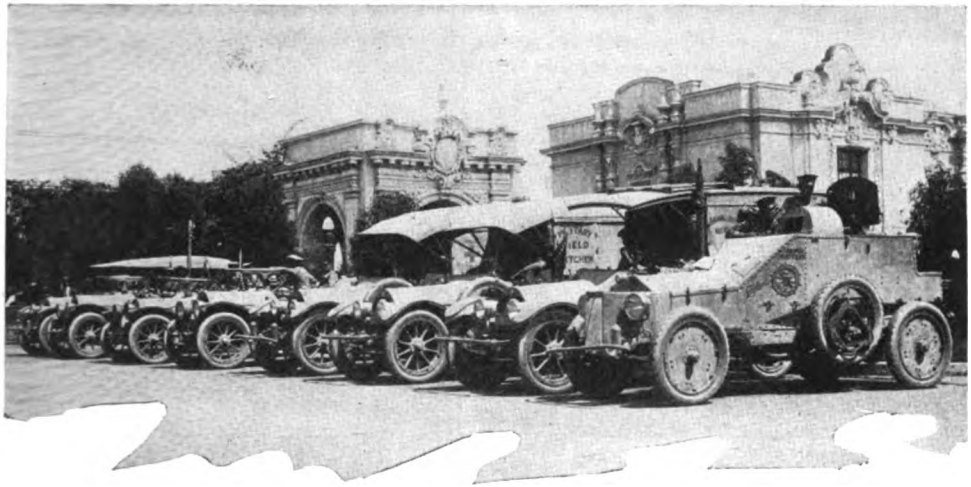

*An armored automobile train. Recently a line of machines ended a run of 5,000 miles at San Diego, Cal.*

# Wireless on the Armored Auto

## A Train which Ran from Wisconsin to California

**By Felix J. Koch**

MEXICAN imbroglios, with their constant rumors of secret understandings between Mexican leaders and Japan, make the possibility of war-clouds on the American horizon not absolutely remote; cautious Americans are therefore not without interest in what preparations there may be with us in event of war.

Not the least valuable of such phases of both defence and aid to offense is the means of communication between fighters and base, and in that connection especial interest attaches to the arrangement of the wireless station on the armored motor-car of today.

The pictures tell the story better than words; in them are shown the arrangement of the wireless station occupying the rear end of one of the cars in the armored automobile train of a military and naval academy of Lake Geneva, Wis, which recently ended a run of some five thousand miles at the exposition at San Diego, Cal.

The prime purpose of the unique expedition, it appears, was to demonstrate the usefulness of motor-cars in transporting light rapid-fire guns and wireless equipment over great distances. The horseless caravan, comprising eight cars, several of them armored, left Lake Geneva on June 10. A direct route to the Pacific coast was not taken, for the itinerary permitted of several side trips; the run did not end at the San Diego Exposition until July 22.

The cars are the first of their kind to be sent on a cross-country trip of this length and the run was made primarily that an informative report could be given


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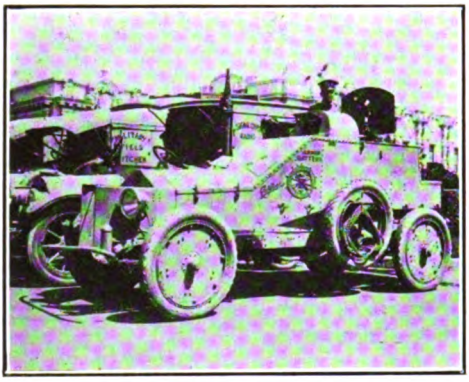
to the War Department. The trip, as a matter of fact, came to a successful end, without accidents en route to cars, drivers or cadets, and the commander is now preparing a report which will include the map of all roads, full details of fuel consumed, tires used, speed maintained and the like. The wireless car contains full equipment which the boys are able to set up for almost instant use.



*Ready to ride*

*The wireless station aboard*

## SOMETHING ABOUT SKAGWAY

Writing from Skagway, Alaska, W. R. Barnes and A. E. Kindell offer some interesting facts for the benefit of the readers of this magazine.

"We are hemmed in on all sides with mountains ranging from 4,000 to 8,000 feet," says the letter, "less than five miles distant. These are laden with gold and copper ore and a recent find of molybinite. We have a seven-wire aerial, No. 17 phosphor bronze, suspended solely at each end and 1,998 feet long. It is 75 feet high at the lowest end and rises to a bluff 584 feet high, upon which rests a 27-foot pole; the wire has a sag of 90 feet. It is used for receiving together with valve detector, 2,000 ohm phones, series and parallel variable condensers across secondary, loose coupler and detector. The loose coupler is of special construction with a wave-length range of from 600 to 7,000 meters. We copy NTL (San Diego) every night and have also heard the station on the Panama Canal as well as all the government stations and commercial stations in the Alaskan interior and the coast.

"We are entirely surrounded by mountains, being situated at the head of the Lynn Canal in the Skagway River Valley.

"We use a horseshoe magnet on our vacuum valve, thereby increasing its life and sensitiveness two-fold; the battery to light the filament lasts longer on account of requiring less current strength to get the desired results.

"We hope to do considerable long distance work this winter. Alaska has every other place—no matter where—skinned for freak work. The nights are cold and clear and signals come in very distinct."

### Naval Station Temporarily Closed

Orders from Washington on October 9 closed the new radio station at the Great Lakes Naval Training station for two weeks. The government explanation was that during the manoeuvers of the fleet off the Atlantic Coast there was a probability that messages sent to captains of the ships would be interfered with by activity at the Great Lakes station.

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# Designing Your Own Transformer

## Information That May be Used Under Any Conditions Encountered by the Average Experimenter

**By R. H. Chadwick**

WHEN the experimenter in radio telegraphy undertakes to build a transformer from parts which he can obtain readily and cheaply, he often finds that he has available a coil or a core which could be used if the design as a whole were suitably proportioned. It is the purpose of this article to set forth certain general principles, which will serve to guide the amateur in building a correct transformer, but which at the same time will allow much flexibility in design.

We shall designate the low-voltage coil as the "primary," the high-voltage coil as the "secondary," and the magnetic circuit interlinking these coils as the "core."

The first step is to decide on the capacity of the transformer and the secondary voltage required. Then we may calculate the current which each coil is to carry from the following formula:

$$I = \frac{1000W}{E} \qquad (1)$$

where W is the capacity of the transformer in kilowatts, E is the primary or secondary voltage, and I is the corresponding current in amperes.

Having determined the current, we may select the size of wire to be used. The cross-section of the wire should be such that the current density does not exceed 1,300 amperes per square inch in the primary coil, and 1,100 amperes in the secondary coil. The cross-section is

$$A = .785\ D^2 \qquad (2)$$

where A is the cross-section and D is the diameter of the wire in inches. D corresponding to the various B&S gauge numbers may be found in any electrical hand-book or wire table. The

$$\text{current density is } \frac{I}{A} \qquad (3)$$

The next step is to determine the cross-section of the core and the number of primary turns. These should be so related that the "flux density" in the core will not exceed approximately 60 kilolines per sq. in. at 60 cycles, or 70 kilolines at 25 cycles. The flux density is calculated from the following:

$$B = \frac{100000\ E}{3.77\ f\ N\ C\ H} \qquad (4)$$

where B = density in k. l. per sq. in.
E = primary voltage
f = frequency in cycles per second
N = number of primary turns
C = width of core
and H = height of core

Dimensions of the core other than the cross-section are determined merely by the size of the coils. The core is built up of sheets of iron, preferably silicon or "transformer" steel. Silicon steel, however, is not absolutely necessary to the success of the transformer.

It will be found most convenient to build a "core type" transformer in


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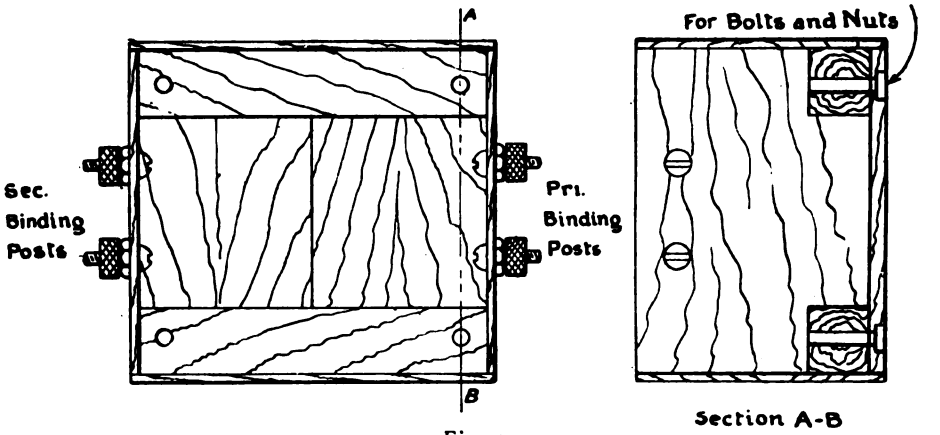


*Fig. 1*

which the core is a simple rectangle, and the coils should preferably be placed on opposite legs of the core. If it is desired for any special reason to use "shell type" punchings, the two coils may be placed side by side on the middle leg. In any case there should be a space of ¼ inch to 1 inch between the coils. If it is found that too much energy is discharged through the gap, overheating the transformer or blowing fuses, this space should be filled with sheets of the same iron used in the core, which device will reduce the energy output.

The primary coil may be either hand or machine wound, using enamel or cotton covered wire. The coil should be wound around a wooden form of suitable dimensions to admit the core decided upon. Several turns of stiff paper or cardboard should be placed around the form, and after winding the form may be removed, leaving the paper to support the coil. A strip of paper not less than .005 inch thick should be placed between layers. This paper, as well as the paper under the coil, should extend at least ¼ inch beyond the actual winding layer on each side, unless special precautions are taken to insulate the coil after winding. The size of the coil may be calculated roughly from the diameter of the wire and the thickness of insulation used, but if the coil is hand wound liberal allowance should be made for the spring of the wire.

The secondary coil should always be machine wound. Enameled wire is preferable, and the insulation between layers should consist of two or three thicknesses of rice paper or similar material. Standard coils suitable for the secondaries of wireless transformers may be obtained from a number of manufacturers at a small cost. Usually the secondary coil will be the starting point from which the various characteristics of the transformer are determined. The number of turns in the secondary coil will determine the number of turns necessary in the primary coil from the ratio:

$$\frac{\text{Pri. Turns}}{\text{Sec. Turns}} = \frac{\text{Pri. Volts}}{\text{Sec. Volts}} \qquad (5)$$

The number of primary turns will determine the cross-section of the core. In selecting a coil from manufacturers' "standards," it must be remembered that the inside dimensions must be such as to admit the core which the foregoing calculations show to be necessary to go with the number of turns on the coil.

The secondary coil must be well insulated. Probably the best method is to tape it three or four times around with strips of varnished cloth or simi-

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lar material, well lapped. If such material is not available, some ingenuity must be exercised to provide several thicknesses of solid insulating material between all parts of the secondary coil and the core or primary coil. Sometimes it is possible to sufficiently protect the ends of the coil with collars cut out of paper, with tongues extending under the coil.

After the core and coils are assembled and the core is properly wedged in place, the transformer may of course be used by simply connecting to the wires coming out of the coils. However, a housing is very much to be desired from the standpoint of both safety and convenience.

may be filled with paraffin or sealing wax, if it is desired to protect the coils against moisture. A well-made box, shellaced or stained, will leave nothing to be desired so far as appearance is concerned.

In a few cases it is thought desirable to provide taps in the primary to vary the secondary voltage. These may be provided by soldering leads at any desired numbers of turns during the winding of the primary coil; remembering always that the ratio of voltages is equal to the ratio of turns, and remembering also that the flux density in the core depends on the number of primary turns actually used and not on the total number in the coil. In general the

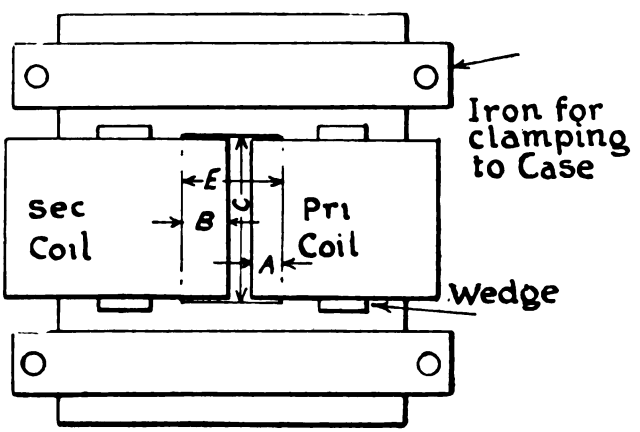


*Fig. 2*

The accompanying diagram, Fig. 1, is a suggestion for a housing that may be easily constructed. It consists simply of a wooden box of suitable dimensions, with two cleats high enough and far enough apart to support the edges of the core, while the ends of the coil are suspended between them. The core may then be clamped by strips of band iron fastened by bolts to the bottom of the box. The leads from the coils are fastened to binding posts, consisting of ordinary brass machine screws, with contact nuts such as may be obtained from old dry cells. Before fastening the cover in place, the box

writer would recommend that a single secondary voltage be decided upon, and the taps be omitted.

To illustrate the method, suppose it is desired to build a ¼ k.w. transformer, having a 12,000 volt secondary, to operate on a 110 volt, 60 cycle, circuit; and suppose we have available, or can obtain from manufacturers' standards, a coil of the following specifications:

| | |
|---|---|
| No. of turns..... | 20,000 |
| Size of wire..... | No. 36 B & S |
| Inside dimensions..... | 2½" x 2½" |
| Max. outside dim..... | 4½" x 4½" |
| Width ..... | 2½" |

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The currents which the transformer must carry are as follows (Formula 1):

$$\text{Pri. } I = \frac{250}{110} = 2.27 \text{ Amps.}$$

$$\text{Sec. } I = \frac{250}{12000} = .0208 \text{ Amps.}$$

From the wire table it is found that No. 36 wire has a diameter of .005" and cross-section of .0000196 sq. in. If the coil described be used for the secondary the current density will be $\frac{.0208}{.0000196}$ = 1060 Amps. per sq. in. The coil, therefore, is satisfactory so far as the size of wire is concerned. From formula (5) the number of primary turns for the correct voltage ratio is 183.

Now, if we allow 3/16" all around inside the secondary coil for insulation, we may use a core 2⅛" square; that is, built up of pieces 2⅛" wide, and stacked to a height of 2⅛". From formula (4) the flux density, with a coil of 183 turns, and a core 2⅛" square, is

$$B = \frac{100000 \times 110}{3.77 \times 60 \times 183 \times 2.125 \times 2.125} = 58.9 \text{ k. l. per sq. in.}$$

This indicates that a core 2⅛" square is satisfactory. If the density had been found to exceed 60, we might have crowded the insulation and put in a slightly larger core; but if the discrepancy had been very great, we should have been obliged to either select a different secondary coil, or put more turns on the primary and use a lower secondary voltage.

Now to select the primary wire, look through the wire table, and choose a wire having cross-section large enough to keep the current density within the limit specified above. It is found that No. 16 wire has a diameter of .051" and cross-section of .00204 sq. in., which gives a density of

$$\frac{2.27}{.00204} = 1112 \text{ Amps. per sq. in.}$$

We will, therefore, use No. 16 wire, unless it happens to be more convenient to obtain a slightly larger size.

If possible, the primary coil should be wound before the core iron is cut in order to determine the outside dimensions of the coil. Otherwise these dimensions may be calculated closely enough, as the build of the coil will be small in any case. We will wind the coil 2½" wide to correspond with the secondary, and will assume that dimension A in Fig. 2 is ⅝".

From the dimensions of the secondary coil and core, it is readily seen that dimension B is 1 3/16" for the uninsulated coil; but allowing for insulation we will call B-1⅜". Now, allowing ½" between the coils make dimension E 2½". Making C's dimension 3" allows ample room for insulation at the ends of the secondary coil.

It is now seen that the core may be built up of rectangular pieces, 2⅛" wide, one-half of them 4⅝" long, and the other half 5⅛" long. To find the number of pieces of each size, divide the height of stack by the thickness of sheets and multiply by 2.

The results of our calculations may be summarized as follows:

Primary coil, 183 turns of No. 16.

Second coil, 20,000 turns of No. 36.

Core, 4¼"; stack of pieces 4⅝" x 2⅛", and 4" stack of pieces 5⅛" x 2⅛".

A few extra pieces of iron should be available for filling in between the primary and secondary coils, in case it is found necessary to reduce the energy.

## PUPIN PERFECTS A NEW RECEIVER

Professor Michael I. Pupin recently delivered an address before the National Academy of Science in the American Museum of Natural History, New York city, in which he declared that he had succeeded in perfecting a receiver which is sensitive only to such waves as the operator wishes to employ.

In his address Professor Pupin explained how he had evolved the idea of the amplifier which made the recent wireless telephone conversations between Arlington and Honolulu possible. He said the idea had come to him from the tiny cells in the human ear that amplify and make audible the faintest sounds. He explained his idea to scientists who developed it later under his direction.

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# With the Amateurs

Reporting football games by wireless is increasing in popularity. Among the games covered in this manner may be mentioned the annual combat between the University of Iowa and Northwestern. A detailed report of the game's progress was sent out by the University of Iowa station.

A waiting throng of Pittsburgh rooters also learned the details of the gridiron clash between the Carnegie Tech. eleven and the rival Case team by wireless flashes from Cleveland. Members of the radio club and other students interested in wireless telegraphy, assisted Prof. A. F. Van Dyke in receiving the news. Among the rooters who accompanied the Tech. team to Cleveland were C. K. Little and J. J. Pannabaker, electrical engineering students, who formerly were Marconi operators on the Great Lakes.

Among the December activities of the Atlanta Wireless Club is the maintenance of an interesting exhibit of Georgia amateur apparatus at the electrical show to be held in Atlanta, Ga., during the week ending December 4.

A complete Marconi wireless set, including a two-kilowatt sending set and a cabinet receiving set, has been recently purchased by the electrical department of Union College. It is planned to build an addition to the laboratory to house this new wireless apparatus and make it a first-class radio station, and a club will be formed at the college for all men interested in wireless.

The University of Wisconsin is also operating a new station under the supervision of the physics department and the course in electrical engineering.

The preparedness principles advocated by the National Amateur Wireless Association proved a good thing for David F. Snow, the Arlington, Mass., youth, charged by the United States Government with having transmitted radiograms and signals without a license. United States Commissioner Hayes, before whom the boy appeared on October 23d, gave him three months in which to perfect himself in wireless telegraphy, on the assumption that he will then be in a position to give valuable service to the State or Nation in time of need.

Young Snow was instructed to appear before the Boston United States radio inspector at the end of three months. If qualified he will then be licensed.

Six Los Angeles, Cal., amateurs have run afoul of the radio law and their names have been referred to the United States district attorney for prosecution. Three have been using wave-lengths in excess of 200 meters and the other three operating without licenses. One of the wave-length offenders is also accused of using improper call letters, the maximum penalty for which is a fine of $100 and imprisonment for two months.

The trend of thought in boys' organizations is illustrated by the report from Orange, Texas, that Stanley Barners, master of the local boy scouts, is to purchase wireless telegraph apparatus with the fifty dollar check received for services rendered in taking care of the Johnsons Bayou flood sufferers during the month of August.

Charles E. Apgar the amateur who aided the government secret service operatives in securing phonographic records of the Sayville station's transmitting, has recently given several demonstrations of his methods in Y. M. C. A. lectures. Mr. Apgar is using circuit diagrams which have appeared in THE WIRELESS AGE to illustrate his addresses.



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Twenty Massachusetts members is the nucleus upon which the Amateur Radio Association of New Bedford has recently been founded. Douglass Tripp is secretary and invites correspondence with other clubs.

The Wireless Club of the Central Y. M. C. A., of Trenton, N. J., is contemplating the purchase of a high-powered sending set, according to Norman Steward, secretary.

At a recent meeting of the Arlington Radio Club of the Arlington High School (Mass.), the following officers were elected: W. C. Clark, president; Eliott Perkins, vice-president; Harold O. Bixby, secretary-treasurer. The club is under the direction of experienced men and will soon have in operation an efficient ½ or 1 k. w. transmitting set.

Coming into official existence on November 2d, the Inter-city Radio Association has established headquarters at 722½ N. Penn street, Allentown, Pa. John S. Bernhard is president and announces that meetings are held every Tuesday evening, each member owning a complete station equipment and lending enthusiastic support to the weekly programs.

The Ann Arbor High School Club has been merged into the Y. M. C. A. Radio Club of Ann Arbor, Mich., and has retained its full membership. Communication has been established up to distances of 50 miles, using a ½ k. w. transmitter and straight gap, reports Walter R. Hoffman, secretary.

A state-wide organization is the object in view for the fifteen charter members of the Oklahoma Radio Experimental Association, of Oklahoma City. A central station is now under construction and an invitation is extended to the whole amateur fraternity of Oklahoma to communicate details of the range and power of their stations. Clifford A. Smith, 922½ W. Main street, Oklahoma City, Okla., is secretary.

The regular meetings of the Franklin-Janvier Wireless Club are to be held on Thursday evenings throughout the winter. Sydney Haynes, Franklinville, N. J., R. F. D., is secretary.

A library for the use of members has been added to the equipment of the Rockaway Radio Club, 296 Washington avenue, Rockaway Beach, N. Y. L. Wagerer reports a material increase in membership as a result of two interesting meetings held recently. H. Conway has been elected president.

In a list of special stations published in the November issue of THE WIRELESS AGE appeared 9ZE, Claude Sweeney. This should have read 9ZE, Philip E. Edelman.

The Carrollton Wireless Club was reorganized in the laboratory of the public school, at Carrollton, Illinois, November 25th, and will henceforth be known as the Carrollton Radio Intercommunication Club. Ward Dickson was elected president; David Roberts, vice-president; Stuart W. Pierson, secretary and chief operator, and Owen Jarboe, treasurer. The purpose of the club is to regulate the wireless traffic in Carrollton, to make the members proficient operators and to study the art of radio communication. The club will meet every other Tuesday. At each meeting papers pertaining to some special topic will be read and a discussion will follow.

## RADIO INSTITUTE MEETS

A meeting of the Institute of Radio Engineers was held on Wednesday evening, November 3d, in room 301, Fayerwether Hall, Columbia University, New York City. A paper on "The Impedances, Angular Velocities, and Frequencies of Oscillating Current Circuits," by Professor A. E. Kennelly, was presented. Professor Kennelly has developed a new method of finding the true periods and dampings of any system of oscillating circuits. A second paper on "The Use of Multiphase Radio Transmitters," by William C. Woodland, was also presented. The advantages obtained by using multiphase currents and a number of rotary gaps, insofar as high spark frequency and low high-tension condenser capacities are concerned, were discussed.

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# From and For those who help themselves

## Experimenters' Experiences.

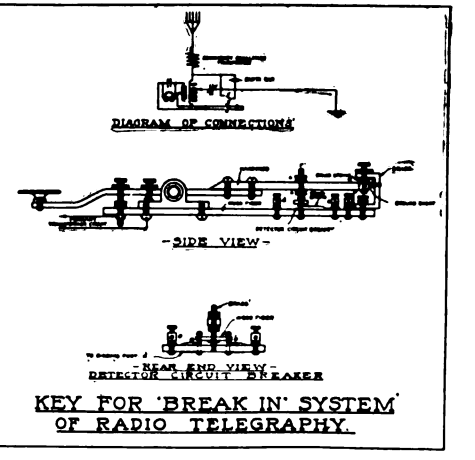
*The editor of this department will give preferential attention to contributions containing full constructional details, in addition to drawings.*

### FIRST PRIZE, TEN DOLLARS
### A Break-in System Which Has Simplicity of Operation

Seven years of experience in amateur wireless telegraph work have so far failed to bring my attention to a break-in system suitable to amateur radio apparatus. Either the key works awkwardly, the detector refuses to remain in adjustment while transmitting, or an open circuit causes trouble. The key I now use does not entirely fulfill the requirements of a perfect system, yet it is the best I have been able to develop and is superior to those described by other experimenters. My design is a combination of features common to the ordinary break-in keys with certain added mechanical advantages which simplify the operation and make it less awkward to manipulate.

With mineral detectors it is necessary that the key disconnect the detector entirely from the crcuits of the receiving apparatus. It is likewise essenial that the telephone receivers be protected by shunts placed across the entire receiving apparatus while the key is closed for sending. In ordinary break-in systems extra contacts are added to the common key and must be very carefully adjusted for satisfactory operation. In addition, they are not apt to stay in that condition for an indefinite period. The key shown in the accompanying illustration performs the necessary functions and does not need readjusting once it is properly set. The operation is easy, the construction simple, but the necessary parts must be carefully made as play in the fulcrum is bound to cause trouble.

To a large extent the illustration is self-explanatory. It will be observed that instead of the adjustment at the rear of the common telegraph key, the space through which the lever swings is regulated by the nut, N, on the bolt, R. The "back click" of the key is therefore made by the contact which shunts the detector circuit and not by the set




*Drawing, First Prize Article*

screw usually employed. When the transmitting key is depressed, the rear end rises, allowing the brass springs, A and B, to break the circuit at A′ and B′. These springs should be made of No. 30 brass. In pressing against the fibre plate above them they compensate for the extra weight added to the lever of the key.



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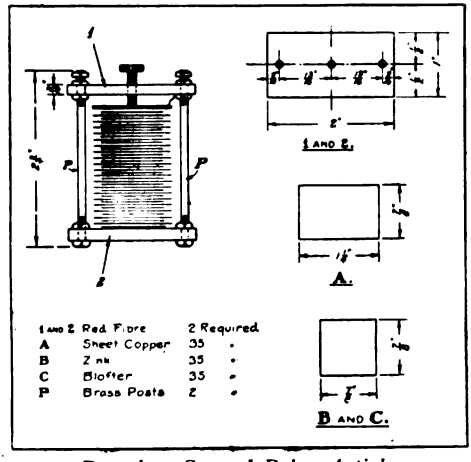
At the same time the spring, C, comes in contact with the screw, F, closing the circuit about the entire receiving set, thus affording a direct path from the oscillation transformer to the earth. An anchor-gap made of two one-cent pieces with a small washer of mica between, affording a minute space, is shunted about C. This will shunt to earth the greater part of the current from the oscillation transformer in case the short-circuiting contact on the key gets out of adjustment.

The illustration shown is not drawn




*Drawing, Second Prize Article*

to scale, but the key I now employ has a wooden arm four inches in length measured from the fulcrum of the key. The short-circuiting contact is at the extreme end, while the circuit-breaker for the detector is one inch nearer the fulcrum. It may improve the operation of the key to add a compensating spring between the detector circuit-breaking contact and the fulcrum. If in constructing such a key other improvements are added by amateurs, so much the better, but I should like to hear about them in order that I may avail myself of the advantages.

JOHN E. WATERS. *California.*

## SECOND PRIZE, FIVE DOLLARS

### Constructing a 35-Volt Vacuum Valve Battery and Rheostat

If the editor of THE WIRELESS AGE will allow me a little space, I am satisfied that I can present the readers of this magazine with a money-saving tip. The majority of us are familiar with the vacuum valve detector; its initial cost is not high, but what about the cost of the secondary batteries, particularly when the fact that certain bulbs require from twenty-five to seventy-five volts potential for satisfactory operation is taken into consideration? To

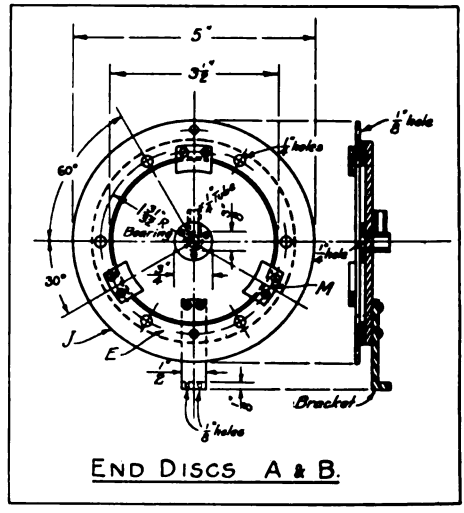



*Fig. 1, Third Prize Article*

be sure, the Fleming valve requires less potential, but many readers possess one of the three-element type.

This article contains instructions for constructing a thirty-five volt battery and rheostat combined which weighs six ounces when complete. It was constructed at an exceedingly small cost.

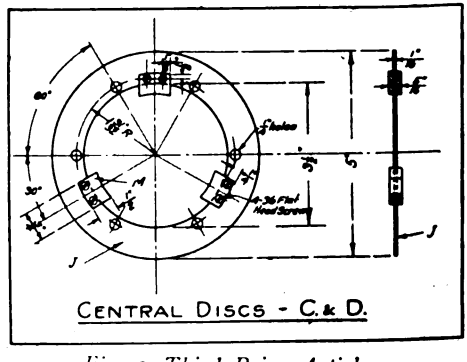



*Fig. 2, Third Prize Article*

The battery can be made for a high or low voltage; and it will be found by experiment that each galvanic couple (cop-

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per, zinc and blotter) will give a little in excess of one volt pressure.

The drawing is almost self-explanatory. Work up the different parts as

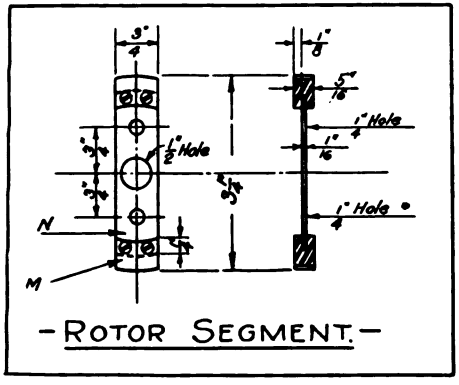


*Fig. 3, Third Prize Article*

shown, then with a little patience assemble carefully as follows: First, a sheet of zinc; second, a sheet of blotting paper, and third, a sheet of copper; repeat until a full number of plates is in position. Leave one zinc plate with an extension for connection. This goes to form one pole and is placed between the fibre bottom and its lock-nut.

After all couples are assembled as shown and the rheostat adjusting screw

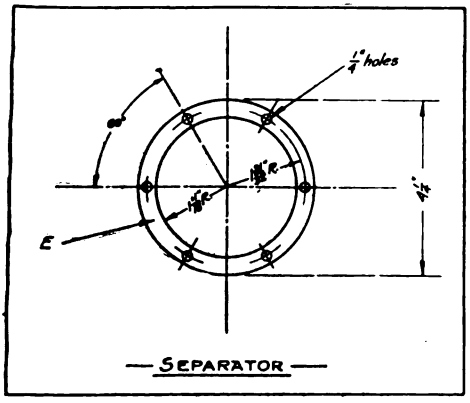


*Fig. 4, Third Prize Article*

screwed up just tight enough to hold them in place, take a ten per cent. solution of sulphuric acid and with a medicine dropper saturate all your blotters. Let the acid stand for a few minutes; then remove all excess solution that is visible. Next connect a suitable voltmeter to the terminals and you will be surprised to see the value of voltage which the battery will give. Variation of the voltage is effected by tightening or loosening the set screw. Once the preliminary tests are completed, ample wire connections should be left and attached to the binding posts. The bat-

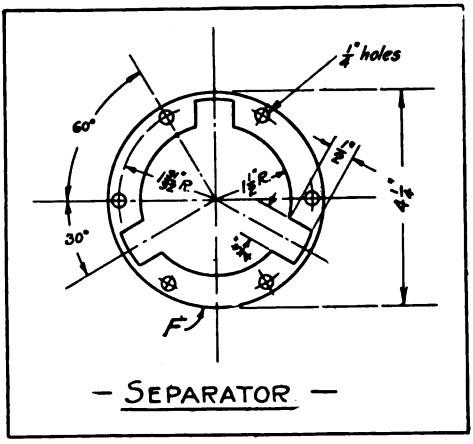


*Fig. 5, Third Prize Article*

tery then should be given a complete coat of paraffine, this tending to prolong its life.

In conclusion, it might be said that the dimensions, the gauge and number of couples are optional with the builder,

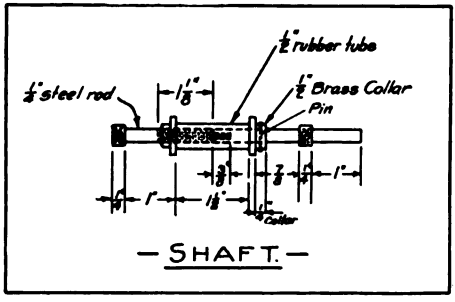


*Fig. 6, Third Prize Article*

but with careful construction this battery will last for years. Try it and be convinced of the accuracy of my statements.

CHARLES E. WILLIAMS, *Georgia.*

## THIRD PRIZE, THREE DOLLARS

### A Rotary Quenched Spark Discharger With a Good Sending Radius

For the average amateur work the rotary spark discharger is considered superior to the plain gap, but increased

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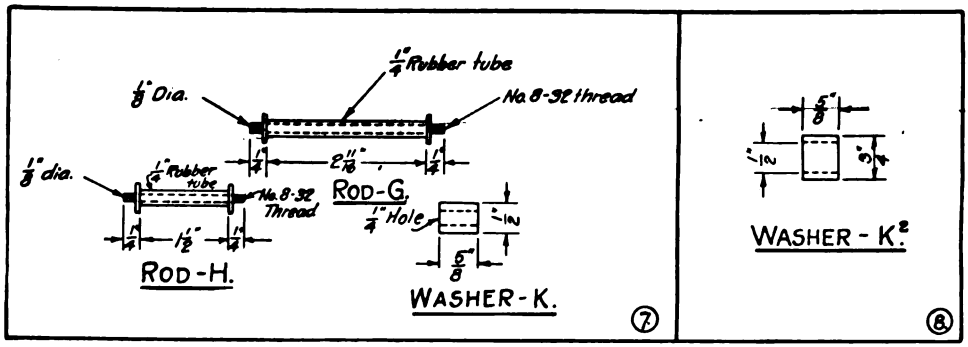


*Figs. 7 and 8, Third Prize Article*

range can be obtained by the use of a properly designed quenched gap. The design herewith described combines the advantages of both and with a certain amount of care and patience in construction may be made with an ordinary set of tools. However, if access can be had to a lathe a much neater piece of work will result.

When operated on sixty-cycle current with a motor having a speed of 1,200 R.P.M. this gap will give six sparks per revolution or 7,200 per minute. It has been my experience that it will give an increased sending radius unobtainable with any other type of gap. It is intended that this gap be operated on transformers of ¼ k. w. or less, but it can be employed in connection with higher power sets if more plates or discs are added.

The materials required are as follows: One strip of brass 1-16 of an inch in thickness, 20 inches in length, and 6 inches in width; one piece of zinc or brass 5-16 of an inch by ¾ of an inch, 8 inches in length; two and one-half square feet of black fibre ⅛ of an inch in thickness, and a quarter inch steel rod 5 inches in length. One inch of brass tube with a ¼-inch hole by 1½-inch outside diameter, and one strip of brass, ⅛ of an inch by ¾ of an inch also are required for the brackets.

Take the 1-16-inch brass strip and cut from it four discs 5 inches in diameter; then cut a 3½-inch hole in the center and drill as per the diagram (Fig. 2). This will make the "ring" parts, A, B, C and D. From the remainder of this strip cut the rotor arms, 2¾ inches by ¾ of an inch by 1-16 of an inch and drill as shown (Fig. 3). Three are required. Next make twelve pieces as at M (Figs. 2 and 3), six for the discs, C and D, and six for the rotor arms. These are made from the zinc piece and drilled for 4-36 flat head screws. The M pieces on the discs A and B are only ⅛ of an inch in thickness. The 5-16-inch pieces have a 1-16-inch notch cut in them as shown.

The foregoing having been completed, fasten the parts in place and assemble the end discs (Fig. 1). Each of these discs is made of one brass circle as described, one separator, E, and one solid piece to which is attached a brass bearing as shown in the drawing. In addition, a hard rubber binding post is attached as shown. Next construct the separators (Figs. 4 and 5); eleven of E and six of F; also two end pieces. This work can be done to the best advantage on a lathe. First cut them out rough with a hacksaw, then space off the holes; drill accordingly. Then, by bolting them together, they can be turned down in a few minuntes to the correct size. Next take each separator and turn out the inner circle, after which the notches in the pieces, F, are cut by hand. Take the steel rod (Fig. 6) and cut it in two pieces, one 2⅜ inches and the other 3 inches in length. Take the short piece and turn it down to ⅛ of an inch diameter for a length of ⅜ of an inch; drill the other piece to a depth of ⅜ of an inch and tap with an 8-32 thread. Thread the other one with the same size die. Then thread it from the shoulder (¼—24) for 1⅛ inches.

Take the joint and drill a small hole through it, then rivet it with a piece of

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wire brad. Make two brass collars 1½ inches in diameter by ¼ of an inch in length with a ¼-inch hole in them; each is to have a 4-36 set screw to hold them on the shaft. Make another, ¼ of an inch in length by ½ inch in diameter with a ¼-inch hole and place it in

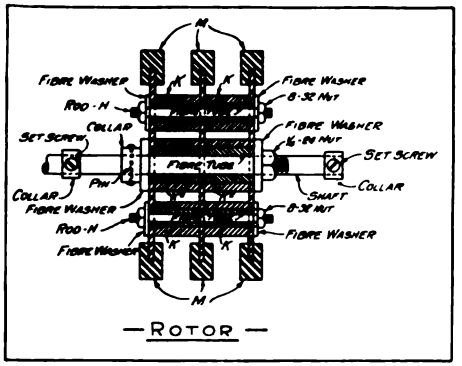


*Fig. 9, Third Prize Article*

position on the shaft. Drill a 1-16-inch hole through it and the shaft, to take a pin. Then slip a fibre tube over the shaft 1½ inches in length by ½ inch in diameter (o.d), and fasten it with two or three pins so that it cannot slip.

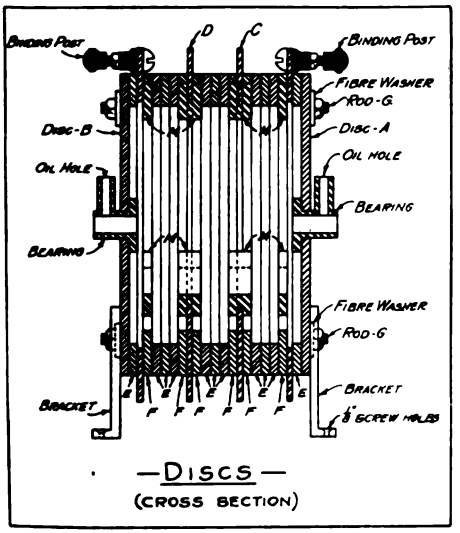


*Fig. 10, Third Prize Article*

Next make two fibre washers to fit against the tube, having an outside diameter of ¾ of an inch and a thickness of ⅛ of an inch.

Next make two rods as shown at H (Fig. 7) and six as shown at G (Fig. 7); also the fibre washers K (Fig. 7) and K-2 (Fig. 8).

The two bearings (Figs. 10 and 11) are made from a ¾-inch brass rod turned down to ⅜ of an inch in diameter by ½ inch in length with a flange on one end, ⅛ of an inch in thickness and having ¾ of an inch o. d. Drill a ¼-inch hole in them and solder a tube in it as shown in details. Now assemble the parts as follows:

Take the shaft and the parts that go with it, making sure that the ¼ 24 notch is on it before fastening the fibre tube. Now put a fibre washer against the nut and place one of the rotor seg-

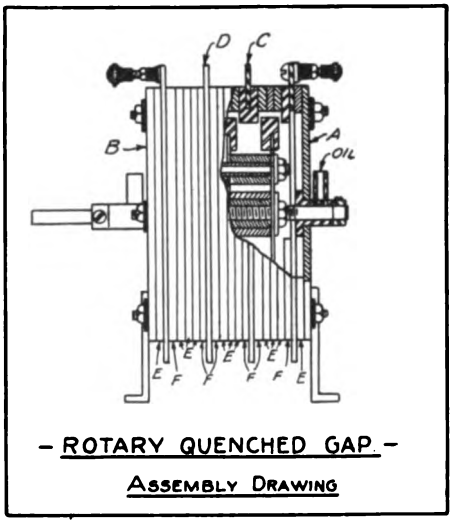


*Fig. 11, Third Prize Article*

ments in place with the two rods, H, and place the washers, K and K-2, in their respective places as per the assembled diagram (Fig. 9). Now take a disc, C, and put one separator, F, on each side; then place the six (G) rods in their respective holes. Place the foregoing parts next to the rotor segments and then insert three separators, E. Repeat this, beginning with a rotor segment until the third rotor segment is in place. Next put the pin in the collar and rivet it tight (Fig. 9); then put the end disc, D, on, after which the nuts and washers for the six rods are placed at this end. Tighten the nut on the other end of the shaft. Now put one of the collars on the (B) disc end of the shaft and fasten it so that the

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space between the rotor plug and the plug on the disc, C, is 1-32 of an inch. When this is completed, place the end disc, A, in position and put the nuts and washers on the rods, G. Be sure to tighten them securely. Then put the other collar on the shaft, after which

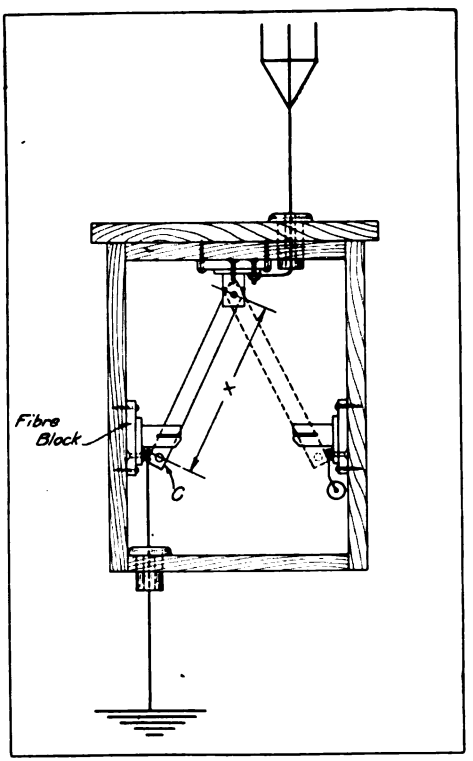


*Fig. 1, Fourth Prize Article*

attach the brackets; the length of these must be left to the discretion of the builder. They should, however, be just long enough to bring the shaft to the same height as that on the motor.

It is best to couple the two shafts together with some sort of an insulating connector. Be sure that only the best insulation is used, as trouble will follow otherwise.

J. E. PUGSLEY, *New Jersey.*

## FOURTH PRIZE, SUBSCRIPTION TO THE WIRELESS AGE

### A Switch That Can Be Worked From the Operating Room

The amateur who is compelled to go outside the building to ground his aerial during a thunder storm will be interested to learn of a switch which can be worked from a distant point without leaving the operating room. The switch which I am about to describe I have found to be very handy and efficient.

Practically any S. P. D. T. switch of the right current-carrying capacity will do for this purpose, while the box can be made of good, straight lumber, the size depending upon the size of the switch. The box indicated in Fig. 1 is 6 inches by 12 inches by 16 inches, inside dimensions.

Any single pole double throw switch that will carry 100 amperes should be demounted from its slate or marble base and each of the contact clips mounted on a piece of fibre ½ inch in thickness and large enough to extend 1½ inches clear of the clips on all sides. If fibre is not obtainable a piece of 1-inch hard maple boiled in paraffine will do.

In the corner of the fibre pieces and at a considerable distance from the switch, contact holes should be drilled

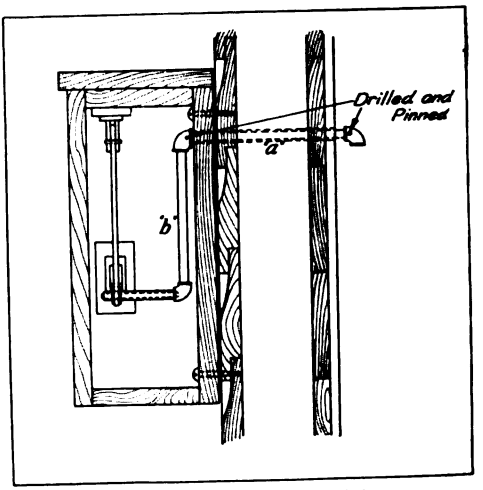


*Fig. 2, Fourth Prize Article*

for fastening the fibre pieces to the inside of the box. The box should be made wide enough so that the clearance between the clips on the opposite side of the box is about the length of the switch blade. This distance will be sufficient to prevent lightning discharges from reaching the receiving apparatus by direct discharge. The blade of the switch should be at least

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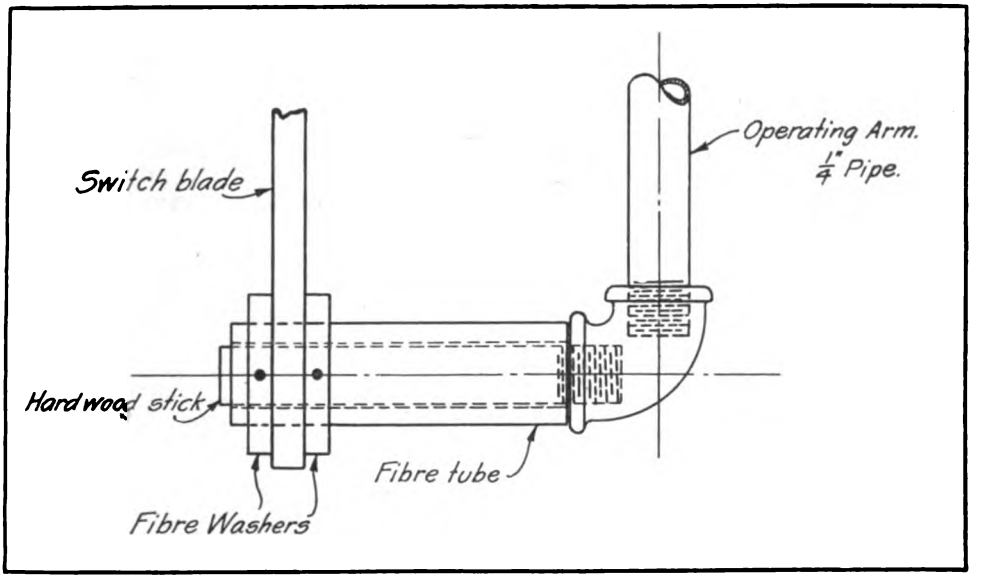


*Fig. 3, Fourth Prize Article*

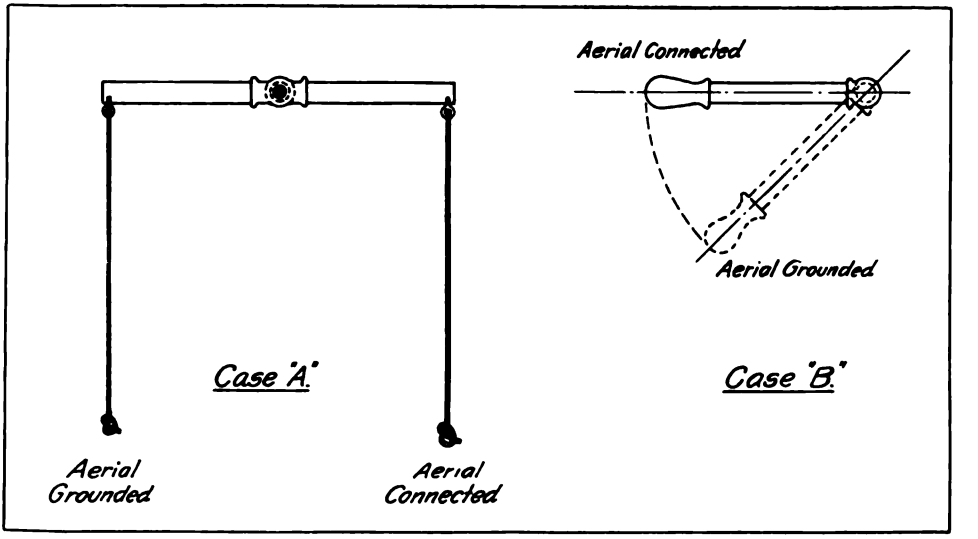


*Fig. 4, Fourth Prize Article*

7 inches in length.

We shall next consider the operating arm which, as indicated, is made of a piece of gas pipe shaped in the form of a crank.

Referring to Fig. 2, the piece of pipe, A, (¼-inch size) should be just long enough to go through the wall and the back of the box, plus ½ inch on eacn end for thread. The piece, B, with an ell on each end, should just equal the distance, X, in Fig. 1, which, of course, depends upon the length of the switch blade. In the lower ell on the piece, B, drive an insulating rod of hard wood, over which slip a fibre tube taken from an inclosed fuse of the right type. A hole should be drilled in the end of the switch blade just below the clips as in C (Fig. 1) to fit the fibre tube. When assembling, a fibre washer should be placed on the tube on each side of the switch blade and pinned into place to prevent any side play of the switch.

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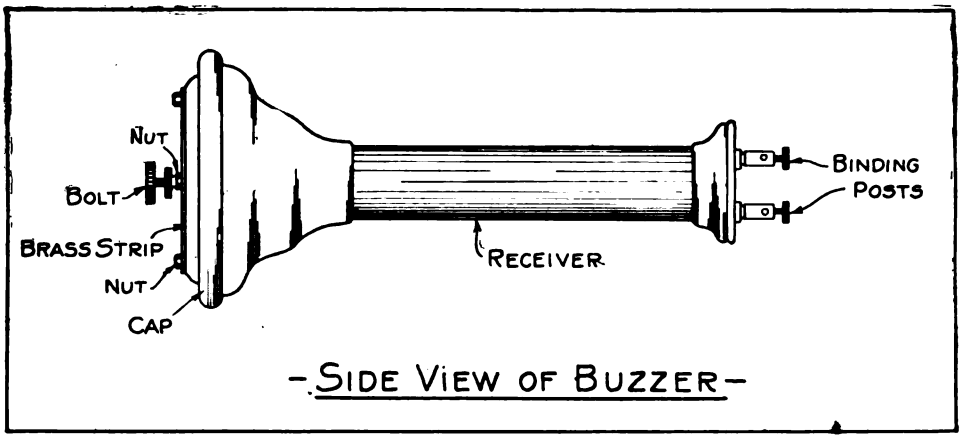


*Fig. 1, Honorary Mention Article, R. M. Dasher*

A porcelain tube should be placed in the top of the box for the aerial leads and as near as possible to the top clip. Proceed similarly with another one immediately below one of the side clips for the ground wire. Then a few inches below and in the back of the box, directly behind the other side clip, bore a hole for the insulating tube carrying the instrument wire which should be fastened to that clip.

If the operating arm is too high to be reached conveniently from the floor a "T" may be screwed on the end and a piece of pipe about 8 inches long screwed into each side of the "T." Then a piece of heavy cord should be tied to the ends of the pipe as shown at A in Fig. 4. If the pipe is close at hand a lever may be made to operate the switch by screwing an ell on the end of the pipe and fastening a wooden handle in the ell as shown at D in Fig. 4.

In case A is employed the ground handle should be weighted and if B is used the arm should be placed so that the lower position always grounds the antenna. In either case it is advisable to drill a small hole and drive a pin through the pipe and fitting at both ends of the piece, A, in Fig. 1, to insure positive action, for if the joints were not made up rather tight the pipe might turn in the fittings and the switch fail to operate.

I believe that with the aid of the accompanying drawings anyone with slight mechanical ability and a few tools will be able to construct a switch of this type with very little difficulty.

W. K. DANVERS, *Oklahoma.*

## HONORARY MENTION

### No Difficulty in Finding Material to Construct a Buzzer of This Type

The buzzer I am about to describe may not be new to some, but I have never seen a similar design published in any magazine. The majority of buzzers described are not satisfactory for test work for many reasons. The drawings (Figs. 1 and 2) will give an idea of the appearance of my apparatus when finished and with a little explanation the amateur will have no difficulty in constructing a set along similar lines. The greater part of the material required can be found in the scrap heap of any amateur experimenter.

The first requirement is an old telephone receiver. Next secure a piece of brass, a few battery bolts, nuts and a couple of contact points. Remove the cap of the telephone receiver and, after scraping a clean spot in the center of the diaphragm, mount one of the platinum contact points in position. By observing the end view of the receiver, it will be seen how the brass strip is fastened to the cap. Drill a hole in each end and one in the center large enough to admit an 8-32 bolt. Then solder an 8-32 nut over the center hole, as shown. Through this the adjusting bolt is to be passed, one end of which is fastened to the other contact point.

Drill holes in the cap corresponding

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to those in the brass strip and bolt the strip fast to the cap. The set is now complete except the wiring and this task, after looking at the diagram, will be found easy. If the diaphragm does not vibrate rapidly enough, it can be made to work better by cutting out

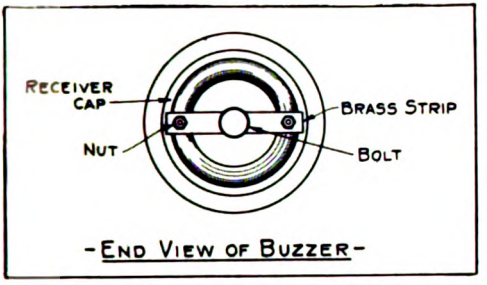



*Fig. 2, Honorary Mention Article, R. M. Dasher*

cardboard rings, placing them on the inside and outside of the diaphragm.

R. M. DASHER, *Ontario.*

## HONORARY MENTION

It is a known scientific fact that negatively charged ions exist around the filament of an ordinary incandescent

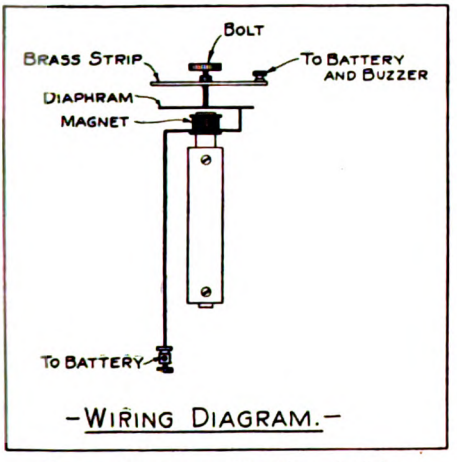
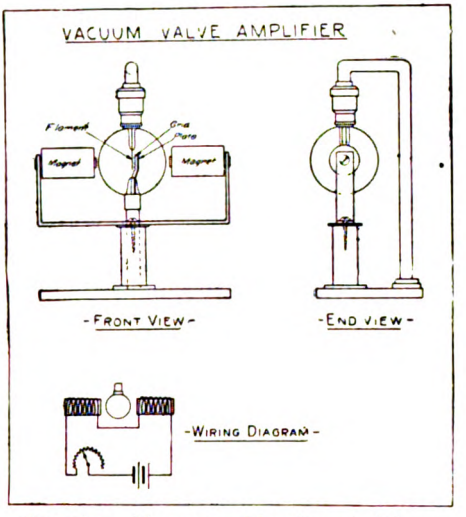



*Fig. 3, Honorary Mention Article, R. M. Dasher*

lamp. It is on this principle that the working of the ordinary vacuum valve relies. But, according to my theory, if these ions spread in all directions, only a few of them are available for actual use in the valve for carrying the current between the grid and the plate. If these ions can be concentrated in one direction the charge that they will convey will be much greater. This has often been effectively accomplished by the use of either an electro-magnet or a permanent magnet which either attracts or repels, according to the polarity; but to still further increase the effectiveness of the action, two electro-magnets of opposite polarity will augment the results. A diagram of this apparatus is shown in the accompanying drawing where two electro-magnets are mounted oppositely on the bulb and connected to the source of electrical energy in such a way that the polarity of the magnets will be opposite.

The magnet is screwed to a "U"




*Drawing, Honorary Mention Article, Ralph Davenport*

shaped piece of iron. This is drilled in the center and screwed to any suitable upright piece of wood or hard rubber of the proper height to bring the magnets in line with the plate and grid of the vacuum valve. This strip must not be screwed up tight, but should be given a little play in order that the magnets may be swung around the bulb to the correct position for maximum strength of signals. The remainder of the drawing is self-explanatory; the dimensions may have to be altered according to the size of the stand and the box upon which it is supported.

With an attachment as shown in the accompanying drawing, the writer has been able to obtain amplifications from

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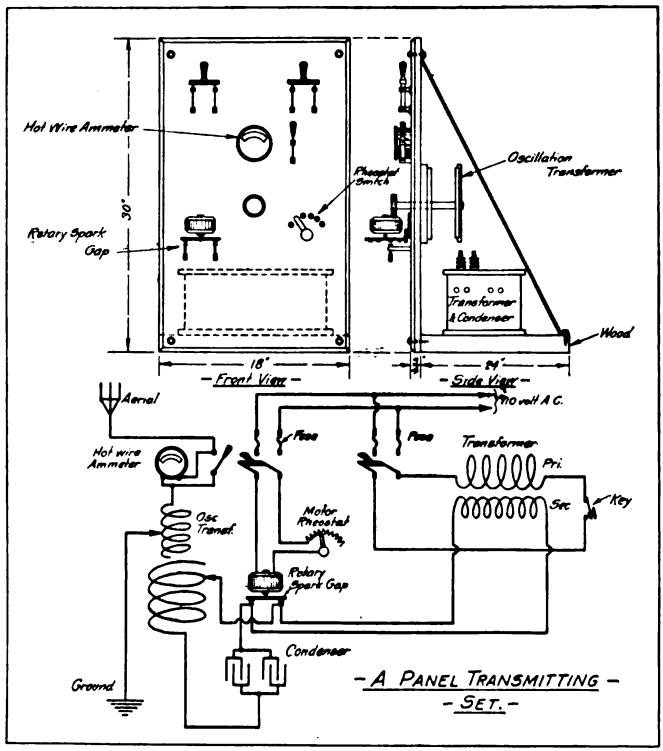


*Drawing, Honorary Mention Article, S. E. Dietrichs*

one to three times greater than those obtained with the ordinary vacuum valve. For given stations it allows the filament current to be reduced and hence the life of the vacuum valve is considerably prolonged. I believe that if similar magnets were applied to a double or triple vacuum valve amplifier, all the magnets being connected in series, the signals would be enormously increased.

RALPH DAVENPORT, *New Jersey.*

## HONORARY MENTION

In the accompanying drawing I offer a suggestion for the design of an amateur transmitting set. No particular type of apparatus is described, but I have outlined a design which I have had in mind for some time. It will be observed that the transmitting condenser and transformer are mounted at the rear of the panel on the base. The inductively-coupled oscillation transformer is mounted on the middle of the board, the knob for controlling the coupling extending through the panel. The rotary spark gap of the average amateur design is mounted to the left of the panel, the regulating rheostat to the right and the aerial hot-wire ammeter to the center of the panel toward the top. The speed-controlling switch for the rotary spark gap and for the circuits to the primary winding of the transformer are mounted at the top of the panel.

I advise that the panel be constructed of marble and have dimensions of 30 inches in length by 18 inches in width, the thickness to be three-quarters of an inch. The connections of the oscillatory circuit are made of high tension automobile cable, the other connections being made of rubber-covered copper wire of the proper size to carry the current.

S. E. DIETRICHS, *Missouri.*

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**Vessels Recently Equipped With Marconi Apparatus**

| Names | Owners | Call Letters |
|---|---|---|
| Princeton | Standard Oil Company of New Jersey | KST |
| Orleanean | R. L. Smith & Company | KON |
| Eurana | Walker, Armstrong & Company | not assigned |

## THE SHARE MARKET

NEW YORK, December 2.

Inactivity in trading prevails, but the brokers believe that this will be succeeded by a revival of interest. Marconis were, of course, influenced by the apathy.

Bids and asked prices today:

American, 3⅞—4; Canadian, 1¼—1⅝; English, common, 9—12½; English, preferred, 8—11½.

## PERSONAL ITEMS

Miss Claire Randel, daughter of Mr. and Mrs. O. A. Randel, of New York City, and Elmer E. Bucher, instructing engineer of the Marconi Wireless Telegraph Company of America, and an associate on the staff of THE WIRELESS AGE, were married in New York on November 1. They are making their home for the present at a hotel in that city. The bride, who has a reputation as a concert singer, is the possessor of a mezzo soprano voice. Mr. Bucher has been connected with the Marconi Company for the last three years.

What was announced as a visit to home folks in Boston, proved to be the occasion of entrance into the bonds of matrimony in the case of F. S. Monschau, Marconi operator on the Brilliant.

C. D. Campbell, manager of the Marconi station at Galveston, Tex., has been elected president of the Galveston Jovian League, composed of business men and officials of that city.

Operator Griffiths, senior Marconi man on the Vauban, has reported that on the night of September 1 at ten minutes after ten o'clock he copied time signals and the weather report from Arlington, the vessel being 3,325 miles distant from the land station. On the night of September 2 he copied time signals and the weather report from Arlington. The Vauban was 3,597 miles away from Arlington. Griffiths said that the signals were distinct.

## THE MARCONI QUIT AGAINST SIMON

Judge Charles M. Hough in the United States District Court, New York City, handed down a decision on November 18th, denying a motion for an injunction by the Marconi Wireless Telegraph Company of America, which had instituted suit against Emil J. Simon, of New York City, employed to construct radio apparatus for the United States Navy, alleging infringement of one of the Marconi patents. The following statement regarding the decision was made by Edward J. Nally, vice-president and general manager of the Marconi Wireless Telegraph Company of America:

"It was conceded to the Marconi Company that its patent was valid and that Simon had infringed upon it, but it was contended that because Simon's infringement was only in connection with the United States government that, therefore, he was immune from all liability.

"This decision raises a question which is of interest to all manufacturers of patented apparatus which may be used by various departments of the United States government, and if Judge Hough's opinion is correct it is believed that it will have an effect not only on those engaged in wireless telegraphy, but also in many other branches of industry. In order to have the matter finally determined, the Marconi Company proposes to carry it to the highest courts, as they believe it will be of interest to many others besides themselves to have this question finally determined."

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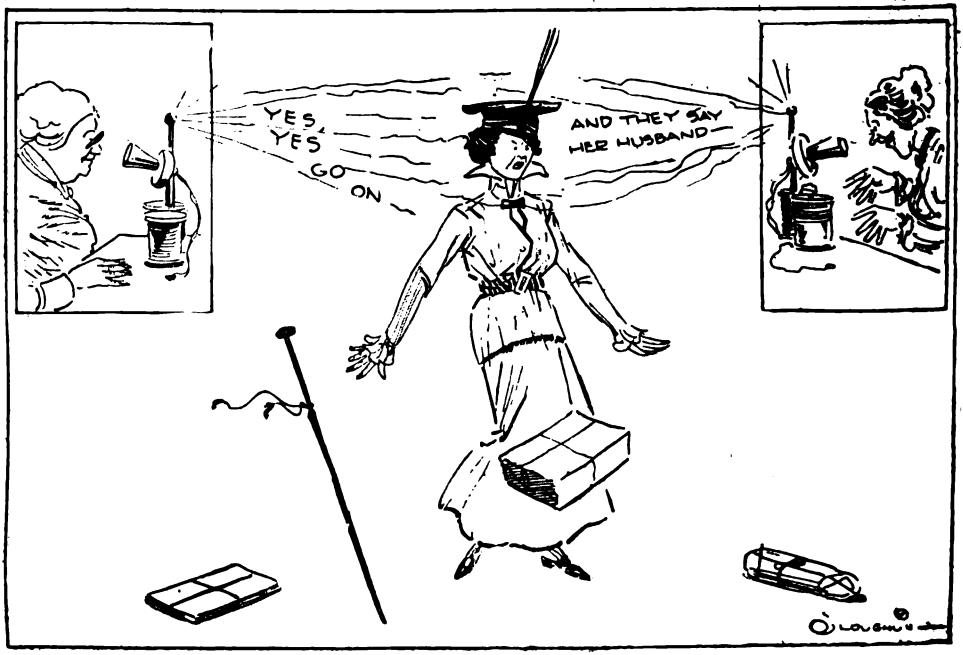
## THE WIRELESS TELEPHONE, AS SEEN BY ARTISTS

"ALLO, NEW YORK, EES T'AT YOU?"

*From the New York World.*

*When a Woman Walks Through a Wireless Telephone Wave*




*From The Portland (Ore.) Telegram.*

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# RADIO RAVINGS

*Conducted by D. Phectiff Inslater*

### That Station

Of all the stations I have worked,
  This station is the best.
A "haunt" for all the lazy boys—
  And those who *need* a rest.

Hard at work at six o'clock,
  Off come coats and vests,
You carry in a pile of wood
  To smoke away the pests.

These pests are mainly different bugs,
  (The skeeters are the worst),
And on the war-path all the time
  For naught but blood they thirst.

With head 'phones on at seven bells,
  You shoot some N-I-Ls.
The spiders get so thick just then
  You pray for shrapnel shells.

At eight o'clock the 'larm is set,
  To wake you up for lunch;
You dim the glim and pull the shades—
  And roll up in a bunch.

At one o'clock you Q-R-U,
  And set your clock for four;
To get that M-S-G report,
  The P & O waits for.

At four o'clock your work is done,
  You've got that M-S-G;
So nap till six, then doctor up
  The log, artistic-ly.

*A (Modest) Reader.*

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Like the small boy whose letter to Santa Claus "covered everything" by asking for two toy shops and a candy store, Operator Jones recently dismissed a great subject with a few words. An electioneering suffragette had become indignant over his indifference to the Cause; with the battle-light in her eye, she denounced him thus: "Why, I really believe you don't know the first thing about the fundamentals of government. Tell me, if you can" (very scornfully delivered), "what *is* political economy?"

"Easy," replied Jonesy. "Political economy consists of getting the most votes for the least money."

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One of the first to join the National Amateur Wireless Association is a man connected with this magazine. Among his military activities may be reckoned recent participation in the mimic warfare conducted by the militia.

The first day he took one of the Red's officers.

The next day he took eight men.

The third day he took a valuable portable wireless station.

And the day before the manœuvers ended he took three transport wagons and a big gun.

He is our staff photographer.

---

I love the Merry Yuletide—yet,
  I notice more, each year I live,
Tho' I always like the gifts I get,
  Oh, how I *love* the gifts I give!

---

DEAR E. M. G.:—

Your thoughtful Christmas gift arrived, a little early, but quite safely. Since you ask, you shall know: up to this date the words gracing this page have been turned out regularly with a plain and simple fountain pen. But thanks for the quill; it's most ornamental. Mayhap, in some rash moment, I shall e'en use it—torn from one goose's pinions, it may yet spread opinions of another, as 'twere.

---

### Received in the Same Mail

Talk about tuning, aerials and spark,
The wireless 'phone if you must,
Talk of detectors till all men depart
Enswirled in a dark cloud of dust.
The National Association you may even
  discuss,
And the volumes that rest on your shelf,
But believe me, ol' kiddo, there'll sure be
  a muss
If you continue to talk of yourself.

OSSIE.

All right, Oswald, not another word.

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# Queries Answered

**Answers will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all letters and only one side of the paper written on; where diagrams are necessary they must be on a separate sheet and drawn with India ink. Not more than five questions of an individual can be answered. To receive attention these rules must be rigidly observed.**

**Positively no Questions Answered by Mail.**

C. S. H., Paterson, N. J.:

Ans.—A receiving tuner for use with a vacuum valve detector, without variable values of inductance and capacity, is certainly not feasible for the average amateur's wireless work. If the receiving station is intended to receive from a single transmitting station, it is possible to design a set with fixed values of inductance and capacity, but since the average amateur desires to place his apparatus in touch with stations having different wave-lengths, the apparatus must be fitted with variable inductances and condensers.

* * *

H. R. H., Hartford, Ct.:

Ans.—The natural wave-length of the aerial described in your communication is about 385 meters, which is, of course, too long for the satisfactory reception of amateur signals. A series condenser will hardly allow the reduction of the wave-length to 200 meters. For amateur work, the flat top portion of a receiving aerial need not be more than sixty or seventy feet in length.

It is preferable that three telephone receivers of unequal values of resistance be connected in series rather than in parallel. The extent to which the signals will be reduced by this connection depends upon the type of receiving apparatus employed and the amount of energy available. With the average crystalline detector, a reduction in the strength of signals takes place when three telephones are connected in series.

* * *

L. H., Bennington, Kas.:

Ans.—A receiving apparatus, fully equal in sensitiveness to that described by Mr. Apgar in a recent issue of THE WIRELESS AGE, is told of in detail in the book "How to Conduct a Radio Club," which can be purchased from the Marconi Publishing Corporation, 450 Fourth avenue, New York City. This volume can be obtained by enrolling as a charter member of the National Amateur Wireless Association. At the present writing the Sayville station operates with undamped oscillations at a wave-length of about 9,000 meters; in consequence your apparatus is not suitable for the reception of the Sayville signals.

Ques.—To eliminate dead-end effects, is it necessary to break up the dead end portion of a winding or simply disconnect it from that part of the coil in the circuit?

Ans.—It is preferable to disconnect the dead-end portion and wholly remove it from inductive relation to the used portion. However, simply breaking the circuit to the dead end portion assists in elimination of the dead end effect.

It is utterly impossible to give advice concerning an antenna erected in a mountainous district. Freakish reception on aerials thus located has been observed, the aerial responding more violently in one direction than in the other. The effectiveness of such an aerial is best determined by actual experiment.

* * *

G. H. D., Jr., Baltimore, Md.:

The construction of the variometer and a diagram of connections for its use are contained in the book "How to Conduct a Radio Club," which can be purchased from the Marconi Publishing Corporation, 450 Fourth avenue, New York City. It is a part of the equipment of charter members of the National Amateur Wireless Association.

There is an advantage in employing three slides on a tuning coil. By proper connection the use of three slides enables the coupling between the antenna and the local detector circuit to be altered as required.

* * *

A. B., Seattle, Wash., inquires:

Ques.—(1) Which, in the opinion of radio engineers, is the more efficient type of receiving transformer, the common loose coupler with single layer coils or the Blitzen rotary type with multi-layer windings?

Ans.—(1) The single-layer type of coil is preferred. Multiple-layer windings with an excessive number of turns are to be avoided. For receiving tuners of small range, the multilayer winding is feasible, but the best results are obtained with the single layer.

Ques.—(2) Please advise which of the types should be used for "loading" coils.

Ans.—(2) The single-layer coil is preferred for "loading" purposes.

Ques.—(3) Please give the number of turns required to construct a 1,000-meter coil with the following conditions: No. 24 D. C. C. cotton wire in a single layer on a 5-inch tube.

Ans.—(3) Unless you state specifically the type of circuit in which this coil is to be employed, it is difficult to give advice. For example: If it is to be used as the secondary winding of a receiving tuner, it would be necessary to know the value of capacity to be connected in shunt. If it is to be used as the primary winding of a receiving transformer or as a loading coil, it would be necessary to know the dimensions of the antenna with which it is to be employed. Unless this information is at hand, we can make no calculations.


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Ques.—(4) Is the strength of received signals proportional to the height of the receiving aerial?

Ans.—(4) In a vertical aerial yes, provided the aerial is not raised to such height as to exceed the wave-length of the distant transitting station.

Ques.—(5) Which station nearest to Seattle, Wash., employs undamped oscillations?

Ans.—(5) The nearest commercial station which we know of is that of a wireless telegraph company at South San Francisco, Cal. The call letters are KSS.

* * *

W. C. S. Joliet, Ills., inquires:

Ques.—Please give the dimensions for a receiving tuner applicable for 600-meter work?

Ans.—(1) The primary winding of this receiving tuner may be 3¼ inches in diameter by 2½ inches in length, wound closely with No. 28 D. S. C. wire. The inductance may be varied by a sliding contact or multiple-point switch. The secondary winding may be 2¼ inches in diameter by 2 inches in length, wound closely with No. 30 D. S. C. wire. The turns of this winding should be divided between the taps of a six or eight-point switch. The secondary winding should also be shunted by a small condenser of about .0005 microfarad. The aerial described in your communication has a natural wave-length of about 480 meters, which, of course, is not feasible for the reception of signals from amateur stations.

* * *

O. L. G., Brooke, Va.:

The wireless station at Hanover, Germany, can be heard sending to the corresponding station at Tuckerton, N. J., during the early hours of the morning, eastern standard time. The wave-length employed at Hanover is about 8,400 meters. The station at Nauen, Germany, sends at intervals throughout the day. The wireless telephone conversation which you heard was probably that from the naval station at Arlington. The wave-length employed for that work is said to have been 6,000 meters, although measurements made in New York City indicated that the wave-length was in the vicinity of 7,000 meters.

* * *

M. L. N., Woodston, Kans.:

There is no reason why the windings of an inductively coupled receiving transformer cannot be made on a square form. It is generally easier, however, to make the windings on a tube, for obvious reasons.

No one can advise you as to the wave-length of a telephone line, because the conditions vary to such an extent that it would be impossible to make a definite calculation.

We do not advise the use of a multiple tuner in connection with a vacuum valve detector. You will obtain better results by the construction of a receiving tuner, such as is described in the book, "How to Conduct a Radio Club," published by the Marconi Publishing Corporation. Each individual who enrolls as a charter member of the National Amateur Wireless Association will receive a copy of this book as a part of his equipment. The receiving circuit referred to is the most efficient one for long distance work that can be devised and is far preferable to that described in another magazine.

* * *

L. A. T., Concord, Mich.:

If your transmitting set is to be operated at a wave-length of 200 meters, the condenser cannot have a value of capacity of more than .01 microfarad. If the foil of the condenser is to be 7 by 7 inches, as you state, and the thickness of the glass is about ⅛ of an inch, the capacity of each plate will approximate .0006 microfarad. Fifteen or sixteen of such plates connected in parallel will give the desired capacity. However, as the glass will not be able to withstand a potential of 20,000 volts, you will require sixty plates, thirty in each bank, connected in parallel and the two banks then connected in series.

A four-wire aerial, 50 feet in height, should not be more than 40 or 50 feet in length for transmission at a wave-length of 200 meters.

The discs for a rotary gap for amateur work may be made of a sheet of hard rubber, bakelite or light insulating material. Six points fitted to a disc about 8 inches in diameter are all that are required at a motor speed of 4,000 R. P. M.

* * *

R. W., Plainfield, N. J.:

Ans.—(1) We cannot answer more than five questions for one subscriber in an issue. The formula you give for the wave-length of a tuning coil is only approximately correct. On page 843 of the August, 1915, issue of THE WIRELESS AGE, a method for the rapid and simple calculation of the inductance of a coil is given. The distributed capacity of a coil may be calculated as per the formula given on page 22, Volume 1, Part 2, Proceedings of the Institute of Radio Engineers for April, 1913. Having determined the inductance of the coil and its effective distributed capacity, the wave-length can be approximated by the following formula:

Where

$$\lambda = 59.6 \sqrt{L C}$$

$\lambda$ = wave-length in meters
L = inductance in centimeters
C = capacity in mocrofarads.

Ques.—(2) Is there any method by which an amateur can generate alternating current at a variable frequency above the limits of audibility, to be used in creating the heterodyne effect in the local circuit of a receiving tuner?

Ans.—(2) This can be accomplished readily by the vacuum valve circuit shown in Fig. 8 on page 256, Volume 3, No. 3, of the Proceedings of the Institute of Radio Engineers. If a vacuum valve is shunted by an inductance and capacity, it becomes a generator of undamped oscillations the frequency of which may be varied over a given range.

Ques.—(3) Must the local circuit of a heterodyne receiver be tuned to the wave-length of incoming signals as is the detector circuit?

Ans.—(3) The local generating circuit is tuned to a slightly different wave-length in order to create the phenomenon of beats.

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Ques.—(4) Must the primary and secondary of an ordinary variometer be wound to the same resistance or to the same amount of inductance Can No. 32 wire be used for the inner coil and No. 28 or 30 for the outer coil, provided the same number of feet of wire is used in either case?

Ans.—(4) It is preferable that the inner and outer coils have the same size of wire. As a matter of fact, the inside coil of a variometer should have a few more turns than the outside winding, in order that the inductance values of the two coils may be nearly alike. It is not absolutely necessary, however, that these coils have identical values of inductance, but it is to be desired.

The Eithnoven galvanometer once was considered an extremely sensitive indicating device for wireless telegraph signals. But, since the introduction of the vacuum valve amplifier, increased effects can be obtained. The Eithnoven galvanometer is described in the "Text Book of Wireless Telegraphy," by Rupert Stanley.

To increase the wave-length of a short aerial to 8,000 or 10,000 meters, wind up a coil of No. 20 wire on a form 5 or 6 inches in diameter. Speaking roughly, the coil should have a length of about 22 to 24 inches.

The address of the Institute of Radio Engineers is No. 111 Broadway, New York City. The meetings, however, are held at Fayerweather Hall, Columbia University, New York City.

* * *

S. M. P., Johnstown, Ohio:

A sending set to transmit at a distance of thirty miles may consist of a 10-inch coil such as is described in the used apparatus catalogue of the Marconi Company. If this coil is supplied with the necessary voltage and connected to a condenser and oscillation transformer so as to give a wave-length of about 600 meters, you will be able to communicate the desired distance. It is preferable, however, to employ an alternating current transformer such as is described in the foregoing catalogue.

The natural wave-length of your receiving aerial is about 300 meters. No advantage will be obtained by using a zigzag connection such as you describe. It is preferable that the wires at the far end of the aerial be connected together and that the lead-in wires be brought from the extreme opposite end. It is rather difficult to construct a transmitting set of the ordinary type that will cover a distance of thirty miles at a wave-length of 200 meters unless a supersensitive receiving set, such as a triple vacuum valve amplifier, is employed.

We have no data concerning spiral aerials. We have never heard that they are used and see no advantage in adopting that type of construction.

We advise the use of an electrolytic interrupter which can be purchased from supply houses furnishing X ray apparatus to the trade in connection with the induction coil described in your fourth query.

* * *

R. C. T., Pittsburgh, Pa.:

You may consider 2 or 2¼ amperes as a good value of antenna current with the apparatus you describe. Lacking dimensions concerning the transmitting aerial, we are not able to calculate your wave-length, but the capacity of the condenser employed in the close oscillatory circuit, if the twenty plates are connected in parallel, is about .02 microfarad, which is twice the size it should be for a wave-length of 200 meters. If, however, you are allowed to operate on a longer wave-length it may not be necessary to make a change in any of your circuits. The closed oscillatory circuits of a ½ k.w. set should be connected up with at least No. 4 or No. 6 stranded wire. The primary winding of the oscillation transformer should have a No. 4 wire and the secondary may have No. 6. We believe, however, that you are getting the best possible results from the apparatus now in use.

* * *

F. C. T., Plattsburgh, N. Y.:

After careful consideration of your communication we advise you to make no change in construction of the receiving aerial described for use in connection with the reception of Arlington time signals. An aerial 325 feet in length, as described in your communication, is feasible for this work and the fault in reception probably lies in the design and construction of the receiving tuner. We advise a receiving tuner of proper proportions in connection with a vacuum valve or vacuum valve amplifier for the best results.

A receiving tuner for the reception of Arlington time signals should have the following general dimensions: The primary winding should be 3¼ inches in diameter by 5 inches in length, bound closely with No. 24 S. S. C. wire. The secondary winding should be 3 inches in diameter by 5 inches in length, bound closely with No. 32 wire. The secondary winding should be shunted by a small condenser. Multiple point switches should be fitted to both windings such as described in previous issues of THE WIRELESS AGE. With the secondary winding of the dimensions described, at a wave-length of 2500 meters, inductance will predominate in the circuit—a desirable condition for the vacuum valve detector.

* * *

F. L. G., Howell, Mich., inquires:

Do you consider direct coupling superior to loose coupling in a receiving transformer, and if so, why?

Ans.—(1) Equal results will be obtained with either type of receiving tuner provided they are properly designed. The inductively-coupled receiving transformer is more flexible and allows a degree of coupling between the primary and secondary windings to be altered with greater ease, but as far as actual transfer of energy is concerned about equal results are obtained. The inductively- coupled tuner is preferred in commercial work.

* * *

E. M. D., Port Arthur, Texas:

A formula for the inductance value of a multiple layer coil is given in the "Queries Answered" department of the October, 1915, issue of THE WIRELESS AGE.

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E. H. H., Salem, Wis.:

Ans.—(1) We are not familiar with the constants of the circuits for the new navy tuner, nor have we an authentic diagram of connections.

Ans.—(2) We cannot give advice as to the probable origin of the inductive noises which you hear in the receiving head telephone. There may be a direct current motor in your district with a sparking commutator, causing the inductive sounds that you hear.

Ans.—It is quite remarkable, as you state, that you are able to cover a distance of thirty miles with one-quarter ampere of current in the sending aerial. It is likely that the receiving station is fitted with a super-sensitive receiving set and on this account receives the signals.

A list of stations using undamped oscillations appeared in the August, 1915, issue of THE WIRELESS AGE, page 860. Seven of the stations given in this list employ feebly damped oscillations.

* * *

M. H. Wilmett, Ill.:

The new naval station at Lake Bluff, Ill., can be heard communicating with Arlington and other naval stations at intervals throughout the day. Undamped oscillations are employed which, of course, cannot be heard on the ordinary receiving apparatus.

A receiving equipment adjustable to wave-lengths of 10,000 meters is fully described in the book "How to Conduct a Radio Club," which can be purchased from the Marconi Publishing Corporation, 450 Fourth avenue, New York City. The book is a part of the equipment of charter members of the National Amateur Wireless Association.

The dimensions for a receiving tuner applicable to a wave-length of 600 meters are fully given in the answer to W. C. S.'s inquiry, in this issue. A satisfactory diagram of connections for an amateur receiving tuner is published on page 707 of the June, 1915, issue of THE WIRELESS AGE. It is recommended that all amateurs make use of this method of connection, as it is the most efficient that can be devised.

* * *

L. C. M., Weston, Ore.:

It is difficult for us to estimate the range of a transmitting equipment such as you describe. Conditions on the Pacific coast are unusually favorable for long distance transmission and in view of the fact that the greater part of the work is done during the night time it is difficult to calculate the range of a set, even though the dimensions of the apparatus are known.

A good, cheap ammeter for use in connection with sixty-cycle alternating current can be purchased for about $15.

The Marconi School of Instruction at Seattle, Wash., has been transferred to the Y. M. C. A. at that point.

* * *

F. J. R., Jr., Auburndale, Mass.:

A complete diagram of connections for the vacuum valve detector and the associated appliances is shown in the book "How to Conduct a Radio Club," published by the Marconi Publishing Corporation, 450 Fourth avenue, New York City. Each charter member of the National Amateur Wireless Association will receive a copy of this book as a part of his equipment.

* * * *

A. J. R., St. Louis, Mo.:

A. spark station at Arlington, Va., used for transmission of the time signals is said to be of 100 k.w. capacity. The spark frequency is 1,000 per second.

The recent wireless telephone communication was carried on by means of undamped oscillations. It is generally understood that about 300 vacuum valves shunted by inductance and capacity were employed for supplying energy to the aerial circuit.

Galena crystals may be cleaned by soap and water, or by gasoline.

* * *

G. A. B., Alameda, Cal.:

No. 30 wire is too small for use as a loading coil in an antenna system. It is preferable to use from No. 20 to No. 24 wire.

We are unable to state why you do not hear KAK, but we have been informed that the wave-length of this station recently has been increased and possibly your receiving apparatus is not of the proper dimensions to be placed in resonance with it.

An interpretation of the call letters requested is as follows:

VAG, Triangle Isle, Canada; VAK, Victoria, Canada; VAE, Estevan Point, Canada; VAJ, Prince Rupert, Canada.

These stations are under the control of the Canadian government.

The call letters VEN have not been assigned.

The natural wave-length of your aerial is about 255 meters.

* * *

R. B., Sacramento, Cal.:

The natural wave-length of the aerial described is about 200 meters. With the receiving tuner described, wave-lengths up to 3,500 meters should be received, provided the secondary winding is shunted by a variable condenser. If the two loading coils described were connected in series with the antenna system the wave-length would be increased to about 4,500 or 4,600 meters, but unless similar adjustments are made in the secondary winding the apparatus will not be efficient. Loading coils always should be connected in series. There is no advantage in connecting them in parallel except under certain conditions when a lower value of inductance might be required. We do not, in any case, advise the use of a long wave-length receiving set constructed in a haphazard way from pieces of apparatus lying about the station. A supersensitive long distance receiving set is described in the book, "How to Conduct a Radio Club," published by the Marconi Publishing Corporation. The volume is a part of the equipment of charter members of the National Amateur Wireless Association.

* * *

K. B., Gastonia, N. C.:

The July, 1915, issue of THE WIRELESS AGE contained a circuit diagram of a supersensitive

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receiving set suitable for the reception of damped and undamped oscillations. Somewhat similar circuits are described in United States patent No. 1,113,149.

The Sayville station no longer makes use of damped oscillations. The undamped transmitter is employed exclusively for communication with Nauen.

We advise you to accept C's advice on the subject to which you refer in your third query. Keep in mind that the patents for commercial wireless telegraph apparatus are either owned or controlled by the Marconi Company. The quotations you received from outside sources were without doubt from concerns manufacturing infringing apparatus.

You will be able to hear the telephone conversations from Arlington on any receiving set which is adjustable to wave-lengths of between 6,000 and 8,000 meters. The circuits described in United States patent 1,113,149 are particularly well adapted for the purpose.

Ques.—What station is DB, mentioned each night in Arlington's weather report?

Ans.—This is Delaware Breakwater, which is in the vicinity of Cape May, New Jersey.

* * *

W. T. McC., Philadelphia, Pa., inquires:

Ques.—(1) My inverted L aerial, the natural wave-length of which is 240 meters, is within ten feet of a tin roof where the lead-in joins the aerial. The tin roof is grounded. Can this be the cause of getting a very short sending range with a 3½-inch spark coil? My receiving range does not seem to be effective.

Ans.—(1) The tin roof undoubtedly has a disadvantageous effect upon your sending range. Have you examined the earth connection carefully? See that there are no high resistance joints in it.

Ques.—(2) How far should I be able to send under favorable conditions?

Ans.—(2) The distance you will be able to cover depends upon the type of receiving apparatus employed at the receiving station. With a vacuum valve detector circuit your signals should be readable at a distance of from twenty-five to thirty miles. With the ordinary crystalline detectors you cannot expect to send more than ten to fifteen miles. Of course the actual range is governed by conditions external to either the transmitting or receiving station.

The receiving tuner you have in use at present has insufficient dimensions to be loaded to a wave-length in both the primary and secondary circuits of 8,000 meters. Its construction will not afford a sufficient degree of coupling for the maximum strength of signals. We suggest that you obtain a copy of the book, "How to Conduct a Radio Club," which will give you the details of a receiving set adjustable to this wave-length. The volume is published by the Marconi Publishing Corporation, 450 Fourth avenue, New York City. It can be obtained by joining the National Amateur Wireless Association as a charter member.

* * *

J. E. R., Cuenca, Ecuador:

Ques.—(1) Can I use a rotary spark gap on a transformer coil fitted with an electrolytic interrupter?

Ans.—(1) You can do so, but no adantage will be derived. An electrolytic interrupter properly adjusted will give a high spark note and therefore a rotary gap is not required.

Ques.—(2) Will a wireless station located on top of a hill have the same range as another at the bottom of the hill, both the lower and upper stations operating under the same conditions?

Ans.—(2) The actual effectiveness of either station would depend on other local conditions. Speaking generally, we should prefer to place the transmitting station at the top of the hill. If, however, the hill is largely composed of rock, making a poor earth connection, it might be preferable to place the station at the bottom. However, if the station is located at the bottom of the hill it may exhibit strong directional effects, sending better in one direction than in the other.

Ques.—(3) Please tell me where I can purchase a good book covering the art of wireless telegraphy.

Ans.—(3) There are a number of books on sale by the Marconi Publishing Corporation, 450 Fourth avenue, New York City, which will cover your requirements. We refer you to the "Text Book of Wireless Telegraphy" by Rupert Stanley. This is an up-to-date volume giving the details of modern equipments.

* * *

M. M., Paterson, N. J.:

A receiving tuner suitable for the reception of time signals from Arlington is fully described in the answer to the inquiry of F. C. T., Plattsburgh, N. Y., in this issue. Your four-wire aerial, 50 feet in length by 50 feet in height, has a natural wave-length of about 170 meters and the tuner described in F. C. T.'s inquiry will readily allow adjustments to a wave-length of 2,500 meters.

You should be able to hear the signals from Key West at night time, but not during the day.

* * *

P. J. P., Jamaica, N. Y.:

The aerial which you describe as being 100 feet in length by 40 feet in height, comprising four wires, has a natural wave-length of about 315 meters. The two-wire aerial of somewhat similar dimensions has a wave-length of about 290 meters. With the three-slide tuning coil you describe, the aerial system should be adjustable to a wave-length of about 3,000 meters. You should be able to hear the signals from Key West during the night time, also various other stations located on the Atlantic coast. Your daylight range is problematical. It is best determined by experiment.

* * *

T. J. R., San Francisco, Cal.:

Your reconverted ignition coil used as a radio transmitter will require an exceedingly small condenser. We should say, off hand, that a single plate of glass, 8 inches by 8 inches, covered with foil, 6 inches by 6 inches, would give a sufficient value of capacity. In the book, "How to Conduct a Radio Club," a

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condenser suitable for a 3-inch spark coil to be operated at a wave-length of 200 meters is fully described. The book, which can be obtained by enrolling as a charter member of the National Amateur Wireless Association, is published by the Marconi Publishing Corporation.

* * *

L. C. G., Mattituck, N. Y.:

Numerous experiments in wireless telephony have been carried on during the last several months in the vicinity of New York City, one station being located at New London, Conn. This is probably the station which you heard. Similar experiments have also been carried on at Montauk Point, Long Island, but not at a wave-length of 2,000 meters.

The call letters BYN are for the British Admiralty station located at Portland Bill, England.

* * *

F. M., Ridgway, Pa.:

We have no record of the call letters for the amateur stations referred to. You might communicate with the Department of Commerce.

The diagram for amplifying vacuum valves, employing a single lighting battery, is given in the "Naval Manual of Wireless Telegraphy for 1915," which can be purchased from the Marconi Publishing Corporation. This diagram is published on page 143 and includes three separate lighting batteries. A single unit may be used, however.

* * *

D. O. A., Bedford, Pa., inquires:

Ques.—(1) What is the wave-length of an aerial of the inverted L type, 125 feet in length, containing four wires? It is 60 feet in height at one end 30 feet at the other. What would be the wave-length of the section if split in two parts with two wires each?

Ans.—(1) As an inverted L system the natural wave-length of this aerial is about 350 meters. We do not understand how you plan to split the aerial or where the incoming leads would be connected in case this were done.

Ques.—(2) Please tell me whether you would advise the use of a variable condenser for secondary tuning, built along the following lines: The dielectric is to be of paper about 1/64 of an inch in thickness between plates of tin, 3 by 3 inches. It is intended to employ fifteen adjustable and sixteen stationary plates. Would this give good results for secondary tuning?

Ans.—(2) We do not understand just how these plates are to be employed. Is the capacity to be altered by interleaving the plates and sliding them back and forth? If so, the construction is feasible, though air dielectric condensers are generally preferred in wireless telegraph work. Perhaps, however, for the ordinary receiving work in which you may be engaged, the dielectric losses in this condenser will not be sufficient to be taken into account.

Ques.—(3) Please tell me which will give the better results for tuning to wave-lengths up to, say, 6,000 meters: A receiving coupler where the primary is wound with No. 24 enameled wire and the secondary No. 28 enameled wire, or a receiving coupler where the secondary is wound with No. 28 S. S. C. wire and the primary with No. 22 S. S. C. wire. The primary tube is to be 8 inches in length by 5½ inches in diameter; the secondary tube 8 inches in length by 4¾ inches in diameter.

Ans.—(3) We should prefer to have the primary covered with No. 24 S. S. C. wire and the secondary with No. 28 S. S. C. wire. Coils wound with enameled wire have a high value of distributed capacity and in some cases occasion considerable energy losses.

Ques.—(4) Can I secure a long and thick spark from a 1½-inch spark coil by employing a single section of the Murdock moulded condenser of .0015 microfarad, or would I secure a better spark by using a glass photograph plate, 8 inches by 8 inches, coated on both sides with tin-foil, 6 inches by 6 inches

Ans.—(4) We should consider a capacity of .0015 microfarad rather high for a 1½-inch spark coil. The single plate of glass referred to will have a capacity of about .0005 microfarad which is more preferable for a coil of this capacity.

Ques.—(5) Have you been informed whether the Government uses the arc system in conducting its wireless telephone work

Ans.—(5) Undamped oscillations are employed for this work, but they are generated by a battery of 300 vacuum valves connected in parallel. The signals can be received on crystalline detectors, provided the receiving tuner has a range of wave-lengths between 6,000 and 8,000 meters.

* * *

E. B. R., Lancaster, Pa.:

The capacity of two one-quart Leyden jars is by far too great for use in connection with a 1-inch coil. A single plate of glass, 8 inches by 8 inches, covered with tin-foil, 6 inches by 6 inches, will give a sufficient value of capacity for this work. This is probably the reason why you do not receive a better spark. There is a possibility that you have insufficient condenser capacity across the vibrator, but we believe the trouble really lies in the abnormal value of capacity in use at the secondary winding.

* * *

P. H., Indianapolis, Ind.:

The March, 1915, issue of THE WIRELESS AGE contained an article on the construction of a variometer. A similar article appears in the book, "How to Conduct a Radio Club," published by the Marconi Publishing Corporation. Charter members of the National Amateur Wireless Association will receive copies of the book as parts of their equipments.

A receiving tuner suitable for the reception of Arlington time signals is described in F. C. T.'s inquiry in this issue. The aerial you describe has a natural wave-length of about 310 meters.

* * *

G. H., Wauwatosa, Wis.:

The natural wave-length of the 200-foot aerial you describe is about 475 meters, which is too long to be reduced to a value of 200 meters by a series condenser. You will secure

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better results by constructing an aerial specifically suited for the transmission on wave-lengths of 200 meters. A four-wire aerial, 40 feet in height by 50 feet in length, is quite sufficient for the purpose.

Ques.—(2) How many plates, 8 inches by 10 inches, will be required for a condenser to be used in connection with a Packard ½ k.w. transformer, secondary voltage 13,200.

Ans.—(2) For a wave-length of 200 meters the condenser should have no more than .01 microfarad capacity. Assuming the plates to be covered with foil 6 inches by 8 inches, the capacity of each plate will be about .0006 microfarad. You will therefore require about sixteen plates connected in parallel. It is a little doubtful whether glass of the ordinary thickness will be able to withstand this potential. If it is not found feasible, then the series parallel connection must be employed.

Ques.—(3) I have constructed an oscillation transformer with eight turns of brass strip in the primary and a similar number in the secondary. Is the instrument of correct design?

Ans.—(3) The information provided is not complete enough to enable us to give definite advice. The oscillation transformer will require no more than one or one and a half turns in the primary winding and the connections from the condenser to it must be exceedingly short. The secondary winding may have from eight to ten turns, depending upon the size of the antenna with which it is to be used.

The receiving tuner described will be adjustable to a wave-length in the secondary winding of about 3,800 meters, and for the primary winding we can give no definite data as we do not know the size of the aerial with which it is to be employed. However, if it is to be used with the 475-meter aerial the primary winding described will be adjustable to a wave-length of about 2,800 meters.

* * *

C. H. McS., Pittsburgh, Pa., asks for data for a suitable primary winding for the 10,000-meter coil described on page 378 of the February, 1915, issue of THE WIRELESS AGE. The actual dimensions for this coil will depend upon the size of the antenna with which it is to be employed, but, speaking generally, it may be 9 inches in length by about 5½ inches in diameter, wound closely with No. 24 S. S. C. wire. If the aerial with which it is to be used has a capacity of less than .001 microfarad an aerial tuning inductance must be connected in series.

We do not advise an aerial of less than 800 feet in length for reception of signals at a wave-length of 10,000 meters, although with supersensitive vacuum valve detector circuits, this may be readily accomplished with aerials of lesser dimensions.

The series of articles on "How to Conduct a Radio Club," which appeared in THE WIRELESS AGE, can be purchased in book form from the Marconi Publishing Corporation. Charter members of the National Amateur Wireless Association will be provided with copies of the book.

Apparently you have read all the prominent authors on the subject of wireless telegraphy and therefore should be able to select the one giving advice suitable to your requirements. We recommend "Wireless Telegraph Instruction for Amateurs" by Arthur P. Morgan, also "Experimental Wireless Stations," by Philip E. Edelman, for advice on elementary amateur apparatus.

* * *

J. G. F., Buffalo, N. Y.:

Ques.—(1) The top of the pole for the support of my aerial is 65 feet above the ground. The four wires are insulated at the bottom only. Is it essential that I have insulators at the top for either sending or receiving?

Ans.—(1) The aerial should be well insulated for both purposes.

Ques.—(2) Would one electrose ball insulator at each end of my aerial wire be sufficient for ¼ k.w.?

Ans.—(2) No. We should prefer several of these insulators connected in series, or a single insulator in each wire from 6 inches to 12 inches in length.

Ques.—(3) What would be the natural wave-length of an aerial 60 feet in height at one end and 45 feet at the other, having four wires spaced 2 feet apart. The flat top portion is 100 feet in length with a lead-in of 35 feet.

Ans.—(3) The natural wave-length of this system is about 284 meters.

Ques.—(4) Will a ground lead of 35 feet, No. B & S. gauged wire, be too long?

Ans.—(4) It is not too long, but a larger size of wire is preferred. It should be of at least No. 4 or No. 2 copper stranded wire.

Ques.—(5) What is the average time required to pass through the Marconi School of Instruction?

Ans.—(5) It depends upon the previous training of the student. If the applicant is able to receive in the Continental code at a speed of from ten to fifteen words a minute upon joining, he will require no more than three months' instruction. Occasionally, however, it requires from four to five months' instruction to attain a speed of from twenty-five to thirty words a minute in receiving. The technical course at the Marconi School generally covers three months of instruction.

*Readers who submit questions to this department will greatly facilitate the work of its editor by not requesting immediate answers. Many questions received do not appear in these columns because they are not of general interest. Every effort is made to give prompt service, but as we usually have on hand for each issue more than 5,000 queries, it is obvious that all cannot receive immediate attention.*

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# Announcement and Application Blank

# National Amateur Wireless Association

PRESIDENT, Guglielmo Marconi.

NATIONAL ADVISORY BOARD OF VICE PRESIDENTS

Professor Alfred N. Goldsmith
College of the City of New York, Institute of Radio Engineers.

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President, American Radio Relay League.

Major William H. Elliott,
Adjutant General Junior American Guard.

E. E. Bucher, Instructing Engineer, Marconi Wireless Telegraph Company.

ADMINISTRATIVE OFFICERS:

ACTING PRESIDENT,
J. Andrew White,
Editor, THE WIRELESS AGE.

MANAGING SECRETARY,
Clayton E. Clayton,
450 4th Avenue, New York.

A national organization of wireless amateurs was announced in the October number of THE WIRELESS AGE. Further details of the organization are given in an address made by J. Andrew White, which was published in the November WIRELESS AGE. Reprint copies sent upon request. It is of vast importance to the wireless amateurs of America.

## ENROLLMENT OF CHARTER MEMBERS.

During the next three months, charter members of the National Amateur Wireless Association will be enrolled on special arrangement. Charter members will receive the following:

## CHARTER MEMBERS' EQUIPMENT.

**1st. CERTIFICATE OF MEMBERSHIP.**

The handsomely steel-engraved Certificate, with shadow background half-tone, is sealed and signed by Officers, with the endorsement of Senatore Marconi, as President. Every member will want to frame and place it alongside of his Government License certificate, two documents establishing status as wireless amateurs.

**2nd. AERIAL PENNANT.**

The 36 inch aerial pennant, painted in four colors on scarlet felt, will stand long service at your aerial mast head. Every member will be proud of the National Insignia flying from his aerial.

**3rd. MEMBERSHIP PIN.**

The National Amateur Wireless Association Pin in gold and enamel is the National emblem of the Association. The design shown on this page can but faintly describe its handsome appearance in three colors and gold. The pin has a special patented hub and shank which permits it being securely fastened on the coat lapel or on the vest without turning upside down.

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**4th. HOW TO CONDUCT A RADIO CLUB.**

This splendid book, which has been months in preparation and incorporates portions of articles running under the same title in THE WIRELESS AGE, is re-written to cover every new development, and with a large proportion of new matter. It is the foundation stone of the National Amateur Wireless Association activities. Price of this book 50c.

**5th. LIST OF RADIO STATIONS OF THE WORLD.**

Revised Edition just published. See advertisement. Regular 50c edition.

**6th. HOW TO PASS U. S. GOVERNMENT WIRELESS LICENSE EXAMINATIONS.**

Regular 50c edition of this popular book. Members who already have a copy, see concessions below.

**7th. MONTHLY BULLETIN SERVICE.**

It is intended to make the monthly bulletin service for members of the National Amateur Wireless Association one of the most important features of the Association. This bulletin is to be used in connection with "List of Radio Stations of the World" described above. It will carry all additions (both amateur and commercial) to "List of Radio Stations of the U. S.", issued by the Bureau of Navigation, U. S. Department of Commerce, and secured for members at 15c a copy. It is issued only once a year. The Association Bulletin will keep both lists up to date for you month by month, and in addition, will carry other special and invaluable Association features not obtainable elsewhere.

**8th. ONE YEAR'S SUBSCRIPTION TO THE WIRELESS AGE.**

THE WIRELESS AGE becomes the Official Organ of the National Amateur Wireless Association and will contain full reports of wireless amateur activities, both national and local. It is planned to give published recognition to individual amateur achievement.

## CONCESSIONS:

Those who, *during the past six months,* have become subscribers to THE WIRELESS AGE, or have renewed their subscription, or have purchased any portion of the Charter Membership Equipment, may consider such payment as partial payment of Charter Membership Application as given below. If you have paid for a subscription to THE WIRELESS AGE which includes books which are not a part of the Membership Equipment, then you may credit $1.25 of the remittance as partial payment on the Charter Membership. For example, you may have remitted $2.25 for the combination offer of the 1915 Year Book with one year's subscription to THE WIRELESS AGE. In this combination, the price of both the book and the subscription was reduced, to make the special offer; therefore, you may be credited only with that part of the payment which went to the magazine—that is, $1.25. Coupon subscribers receive no credit for trial orders. Subscribers to THE WIRELESS AGE who *began or renewed more than six months ago,* will secure through full Charter Membership fee a renewal for another year; and their subscriptions will be extended for one year from the time the present subscription expires.

## ANNUAL DUES FOLLOWING FIRST YEAR.

The annual dues are to be not more than $2.00, after the first year. For this, all members are to receive:

1st. The Monthly Bulletin Service.

2nd. THE WIRELESS AGE for one year.

3rd. Special 50c. Instruction Books at 30% off list price.

4th. 10% discount on any book on wireless published, and other features to be announced later.

## THREE MONTHS ONLY OPEN TO CHARTER MEMBERS.

Charter Members will be accepted for three months only on special arrangement. After three months the Initiation Fee of $1.00 will be required.

*(Application blank on next page)*

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**SPECIAL NOTICE REGARDING CORRESPONDENCE.**

As the National Amateur Wireless Association is in no sense a money making enterprise, and as the nominal dues will cover a very small amount of handling expense, it is desired that the correspondence be limited to only the most essential necessities. Read this announcement over again before asking questions. See if the answer is not already given.

Many general questions will be answered in the Service Bulletins; special matters pertaining to local questions should be handled through the Corresponding Secretary of Local Clubs and Associations.

**Clayton E. Clayton, Managing Secretary,**
**450 4th Ave., New York.**

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Checks and money orders should be made payable to: Natl. Amateur Wireless Assn.

**APPLICATION FOR MEMBERSHIP.**

CLAYTON E. CLAYTON, Managing Secretary,

NATIONAL AMATEUR WIRELESS ASSOCIATION, Date.....

450 4th Avenue, New York City.

As I desire to receive full recognition as an amateur wireless worker of the United States, I ask the privilege of enrollment as a Charter Member in the National Amateur Wireless Association and request that you send me the Charter Members' Equipment for which I enclose herewith remittance of $2.50.* (Option.)

I trust that you will act upon my application promptly and forward the equipment to me at the earliest possible date.

My qualifications for membership are given in blank spaces below.

Signature .....Age.....

Street Address .....

Town and State.....

Please credit me with $..... paid for.....

* Option.

In the event that an applicant is unable to send the entire amount of the membership dues with this application, the figure $2.50 may be crossed out and $1.00 written in its place. This will be considered an agreement on the part of the applicant accepted for Membership that the balance of dues ($1.50) will be paid at the rate of 50c per month for the next three months, at which time pin, pennant and Certificate of Membership will be issued. The other equipment will be sent at once.

**FILL IN ANSWERS TO THESE QUESTIONS.**

1—Have you a Government License (give number.....) or do you purpose applying for one?.....

2—If you are under 21 years of age, give names of two adults for references as to character.

Reference.....

Reference.....

3—If you are a member of any Local, State or Interstate wireless club or association, give its name, and name of Secretary with address.

.....

4—Are you now a subscriber to THE WIRELESS AGE?.....

5—If you already have any books included in the equipment, state which ones.....

.....

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# National Amateur Wireless Association

A DIRECTING ORGANIZATION DEDICATED TO THE PROMOTION OF RADIO COMMUNICATION

CALL LETTERS 9PY
S. W. PIERSON
CARROLLTON, ILLINOIS

GUGLIELMO MARCONI, PRESIDENT

Reduced fac-simile of letter head.

## For Clubs and Members of National Amateur Wireless Association

The following list of items of optional equipment is listed at cost price in order to give members and clubs of the Association every material advantage in the way of a complete equipment that may be desired. Prices include transportation charges.

**LETTER HEADS AND ENVELOPES:**
100 National Association Letter heads with imprint of member at left hand side, as illustrated above 75c
Without member's imprint..... 35c
100 Envelopes with imprint..... 65c
*Special prices on 1000 Letter Heads to Clubs.*

**MESSAGE BLANKS:**
Pads of 50..... 10c

**STATION LOG BOOK:**
A record book in which to keep track of all your operations and communications, in paper..... 15c
in cloth ..... 30c

**RADIO STATIONS OF THE U. S.:**
Call list issued by the U. S. Department of Commerce, postpaid.. 18c

**PHOTOGRAPHS AND PICTURES:**
Photographs of important stations, such as Belmar, Arlington, Sayville, Honolulu, etc., 9" x 12", each ..... $1.00

Duotone picture of G. Marconi, with facsimile signature, suitable for framing ..... 25c

**SOLID GOLD BUTTONS,** 14 Karat N. A. W. A. emblem..... $1.75

**WIRELESS MAP OF THE WORLD** in colors ..... 50c

**YEAR BOOK OF WIRELESS TELEGRAPHY AND TELEPHONY,** published at $1.50, special to members and clubs ..... $1.10

**CLUB PENNANTS:** Made of first quality wool bunting, letters and emblem sewed on with cut outs in color and name of club added, prices on application.

Fac-simile of 36 inch Pennant.

Send all orders to
Clayton E. Clayton,
Managing Secretary, National Amateur Wireless Association, 450 Fourth Ave., N. Y. City.


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# THE WIRELESS AGE

Owing to the fact that certain statements and expressions of opinion from correspondents and others appearing in these columns from time to time may be found to be the subject of controversy in scientific circles and in the courts, either now or in the future, and to sometimes involve questions of priority of invention and the comparative merits of apparatus employed in wireless signaling, the owners and publishers of this magazine positively and emphatically disclaim any privity or responsibility for any statements of opinion or partisan expressions if such should at any time appear herein.

JANUARY, 1916

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# When the Zeppelins Came to London

**By George H. Fischer, Jr., Marconi Operator on the Georgian**

ACCOUNTS of air raids on London have been published in the newspapers from time to time, but owing to strict censorship, few details of the attacks ever reach the public. This is the way in which they are usually reported:

OFFICIAL NEWS
Sunday Evening.

A raid was attempted by Zeppelins last (Saturday) night on the east coast. Bombs were dropped but there were no casualties and no serious damage is reported.

I happened to have the good fortune to be able to witness two of these raids and I can truthfully say that much occurs which folk outside of the raided district rarely hear of. The newspaper accounts cannot give any idea of what these raids are really like.

London is far from being a defenseless city and every possible precaution has been taken against these dangerous visitors. All lights which are not absolutely necessary are extingushed and those which of necessity must be lit are shaded so as to shine downwards only. There are hundreds of civilians serving as special constables whose duty it is to see that these regulations are carried out. In some of the outlying districts notices are sent about requesting anyone who had a police whistle in his possession to blow it immediately a hostile air-craft is sighted as a warning to his neighbors.

The Admiralty has placed numerous anti-aircraft guns and powerful searchlights in various parts of the city. Every evening at about eight o'clock these searchlights are given a thorough try out and their powerful rays can be seen far away as they sweep across the black sky. The beams of the lights were plainly visible from the deck of our vessel in the Thames, thirty miles away.

Most important of all means of defense is the Royal Flying Corps. I have it on good authority that there are nearly a hundred of their armored machines about the city of London. With such a defense it would seem to be impossible for a Zeppelin to fly over the city and get away again; yet this feat has been accomplished not only once, but several times in succession.

The first attack that I had an opportunity to observe came at fifteen minutes to twelve o'clock on the night of September 8. It was a very dark night and conditions were favorable for a surprise. At Millwall, where our ship was docked, every light was out. We were not even allowed a lamp at the gangway; and, as we had inflammable cargo, we were tied out in the river and had to climb over a sort of pontoon bridge made of barges. At about half-past ten we heard a crash, and as everyone was expecting "Zepps" we immemdiately jumped to the conclusion that the noise was a bomb. When we got on deck, however, we found that our chief officer had lost his way climbing across the barges and fallen into the river. After some effort we managed to get him aboard and were joking him on his appeparance when another crash sounded; this time it was the forerunner of an aerial attack.

There were five terrific explosions in our immediate vicinity, one breaking the electric light lamps on the dock near us. We later found that the bomb which worked this destruction had dropped more than a hundred yards away. We were unable to see the machines, but the whirr of their engines could be heard very plainly as they passed overhead. I must admit that at the moment this war machine we could



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not see was driving over us, I had a strong yearning to be safe in the shadow of the Statue of Liberty. For some reason the searchlights were rather slow in coming into action, and when they did, the Zeppelins were well under was in a northeasterly direction. Several shells whistled after the rapidly disappearing craft, but they were ineffective.

All of the victims of the raid were civilians, as far as I could find out, and numbered about fifty—mostly women and children. The bombs had been dropped on workingmens dwellings in the neighborhood of the docks and in one street three houses were totally destroyed. Another bomb fell on a baker's shop, and, passing through the roof, ceilings and counter, crashed through to the basement without exploding. Yet it worked considerable damage to the shop by its force alone. The next morning the proprietor hung out a sign with the British war motto, "Business as Usual," and beneath were the words, "Don't give us sympathy, give us an order." Several incendiary bombs failed to explode. These were promptly taken possession of by the police.

The following night at ten minutes after eleven o'clock another and more disastrous raid took place. I was walking down Fenchurch street to the station on my way to the ship when I heard an explosion somewhat similar to those of the previous evening, but of far greater force. Four bombs fell. Before the last had exploded the searchlights were thrown on and directly overhead could be seen the huge yellow cigar-shaped form of the Zeppelin. Everyone was sure that it could not possibly escape now, as there were several batteries in that district. These immediately opened fire. A deafening noise followed. Guns boomed everywhere, even the cruisers at the docks taking pot shots at the tempting target which had not moved since we first sighted it. Every shell that broke near the Zeppelin brought cheers from the spectators in the streets and several persons declared that the machine had been hit. But the big raider still hung in the air as if in defiance of the guns.

Then, like a swarm of bees, the British aeroplanes went up and the Zeppelin gradually began to rise and glide away into the clouds. The aeroplanes themselves were not visible to us at such a height, but the orange flashes of their guns could be seen distinctly against the black sky. The Zeppelin also fired machine guns. This fight in the sky lasted for not more than ten minutes. After that both the Zeppelin and the aeroplanes were soon lost to view.

I was so entralled with the sight I had witnessed that for some time I stood gazing at the sky where a few minutes before the aerial skirmish had taken place. Then the sound of fire bells brought me to my senses. Engines were dashing down the street, and, turning in the direction in which they were headed, I saw another sight to be remembered. The sky was lit up with a brilliant red glow, many tall buildings being silhouetted against it. St. Paul's Cathedral stood in the brightest spot. The glare crept higher and higher in the sky every minute.

The bigness of the events filled me with awe. This was immediately dispelled by the remark of a young man standing near me. "Awfully exciting, don'cher know," he said. "I hope that's my tailor's place. I owe him a beastly awful bill!"

In the morning I went to see what damage had been done and found the flames still smouldering. One building, which I was informed had been a church, was totally destroyed. Another bomb had dropped on a motor bus in front of Liverpool street station and blown it to bits. Windows in this district had been smashed and in another street an entire block of shops had been wrecked. The streets were roped off and no one was allowed to see too much, but it was evident that there had been a large property loss. There had also been several small fires. The casualty list showed the names of fifty-two civilians and two soldiers. The attack was made by three dirigibles, but I only saw one.

That was enough.

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# BOOK REVIEWS

EXAMPLES IN ALTERNATING CURRENTS. *By Prof. F. E. Austin.*

No one desiring valuable information regarding the fundamental theories of alternating-currents can afford to be without this book.

There are two classes in particular to whom the volume will appeal, and whom it will greatly assist: students of electrical subjects who are unable to pursue regular college courses, and those engaged in practical work who desire working information relative to alternating-currents. Those pursuing correspondence courses as well as regular college students will also find the book of great value.

The immense amount of labor and time which has been put into working out the examples, will save just that much in time and labor of others. The technical information is given in such clear and simple English as to be readily comprehended by the ordinary high-school student.

Those who desire to construct apparatus or to clearly understand the fundamental principles underlying the transmission of power or of wireless telegraphy, will find the text of considerable assistance.

The fundamental information relative to coils and condensers is the most complete ever written; while the various tables of mathematical and physical data are arranged for easy and quick reference.

Copies bound in flexible leather may be purchased from Book Department The Wireless Age, 450 Fourth Avenue, New York, $2.40 postpaid.

THE BOOK OF WIRELESS. *By A. Frederick Collins.*

For the absolute novice who knows little or nothing of electricity in a fundamental way, this book is particularly appropriate. From cover to cover it concerns itself solely with how to make simple equipment; it tells in turn how to make a small outfit, describing sending equipment receiving aquipment and aerial at a total cost of material of eleven dollars; and then describes better equipment to be constructed as progress is made, costing about four times the sum, but good up to 100 miles' transmission and capable of much greater distances in receiving. A dozen pages cover the necessary information on how wireless works and a short chapter deals with code practice. Government regulations for amateurs and twenty pages of definitions of terms and generally useful information make the book complete for the field it seeks to provide for.

In the third part the construction of a half-inch induction coil and half-kilowatt transformer are fully described. Every step is covered in such a manner that the directions can be followed by any schoolboy, 219 illustrations facilitating the work greatly. Written solely for beginners, this book is as good, if not a trifle better, than its predecessors. Sold by Book Department, The Wireless Age, 450 Fourth Avenue, New York, at $1.00.

## ANOTHER FORD CAR STORY

There seems to be no end to the uses of a Ford car. It was a Ford which helped in getting Galveston in wireless communication with the outside world, after the big August storm.

A report forwarded to the New York office of the Brush Electric Co. of Galveston, the tall chimney of which was used as a wireless tower after all other wireless stations had been blown down, tells the story of how the Ford helped. The electric company managed to keep a dynamo running to furnish current for the operation of the wireless, and the manager reported as follows:

"To keep the plant running, boiler water was hauled in cans from the ice company's well, and fuel oil was pumped to the plant from the storage reservoirs, by belting one rear wheel of a Ford to the oil pump. The aerial was stretched from the top of the stack to the nearest pole, and the other apparatus was set up in a room in the basement. Monday morning the electric plant and Galveston were successfully communicating by wireless with the rest of the world."

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*Above, operating the combined telephone and wireless buzzer. At the right, motorcycle to carry wire for the combined telephone and wireless buzzer system*

*Private Davis, whose duty it was to pick up the wire reeled out by the motorcycle and conceal it from the enemy*

*Receiving orders on the firing line by wireless. Corporal Oberland is shown in the photograph*

# The Portable Set in Mimic Warfare

## How It Was Employed By the Massachusetts National Guard in a Preparedness Demonstration

IN these days when wireless telegraphy occupies a prominent place in plans for war preparedness there is especial interest in the announcement that the Massachusetts National Guard at its demonstration camp held recently on Boston Common, successfully employed a field radio equipment. Those who have closely followed the history of wireless in connection with military affairs, will recall that experiments with equipments of the portable type began in 1902.

The transmitter of the first Marconi cavalry equipment differed only slightly from the later type except that the latter was not so convenient for operation and the original apparatus required the protection of a tent when rain fell. A dynamo driven by a pedal gear, which was made to fold into a case for transportation, provided the power.

Three horses were used at first to carry the station, but afterwards the number was increased to four. More elaborate cart stations were designed, a range of almost 100 miles being obtained by them in 1910 in Italy. The stations were taken to Switzerland where communication was established between different points, notwithstanding the difficulties to be overcome.

It goes without saying that the members of the Massachusetts National Guard were not confronted with the same difficulties in their demonstration that faced those who carried on the tests in Switzerland. The Signal Corps, Ambulance Corps, several machine gun companies and a company of infantry took part in the demonstration in Boston. The exercises of the Signal Corps included the setting up of a field wireless station, in which a motor tricycle cart was used. The demonstration was carried on as though actual war conditions prevailed, the line being reeled out and concealed. Operators worked in the rear of the firing line and at headquarters.

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## THE WAR

### How Wireless Is Being Employed in the Hostilities

A dispatch from Athens, Greece, says that an S O S call reached Athens on the morning of December 4 from an unnamed American ship, the message stating that she was being attacked by an Austrian or a German submarine south of the Island of Crete. Subsequent efforts to communicate with the vessel were fruitless.

The American Legation in Athens sent a report regarding the matter to Washington.

Marconi wireless was employed to a considerable extent on Henry Ford's peace ship, the Oscar II, during her recent trans-Atlantic voyage, messages being sent by wireless to each monarch in Europe. They read in part as follows:

"We do earnestly entreat you and the rulers of all the other warring nations to declare an immediate truce. Let the armies stand still where they are. Then let the negotiations proceed, so that the soldiers may be delivered from another bitter winter in the trenches, and sent back to their labors and their firesides. As there is no other way to end the war except by mediation and discussion, why waste one more precious human life?"

A wireless message was also sent to Washington, asking support for the peace mission. Newspaper correspondents on the Oscar II used the Marconi wireless service to send reports of the events occurring on the ship and the progress of the voyage.

A wireless message sent on December 11 to C. W. Bowring & Co., of 17 Battery place, New York City, shipping agents, said that the British freighter Tyninghame, which had left Pier 4, Erie Basin, Brooklyn, N. Y., for Liverpool, with 5,000 tons of sugar for the British Government, was on fire in No. 4 hold and was returning to port. Captain David Jones in his message requested that assistance be sent immediately and the fireboat Seth Low met the burning steamer after she had been anchored between the Statute of Liberty and Staten Island.

When the Seth Low went alongside the hatches were taken off and several hundred tons of water were pumped down onto the burning sugar for three hours until the blaze was subdued. By that time the fire and water had ruined several thousand bags of sugar valued at more than $75,000.

While the Tyninghame was being loaded in Erie Basin on December 5, fire started in No. 4 hold and caused $20,000 damage before it was got under control. Th esecond fire was in the same hold, and started among the new sugar shipped to take the place of the sacks that were destroyed in the first fire.

Several fires have been started by bombs or chemicals hidden in the holds of ships since the outbreak of the European war.

A representative of the United States Navy Department came to Baltimore, Md., on December 14, and dismantled the wireless apparatus on the Hamburg-American steamer Bulgaria. After the antenna had been removed a wax seal was placed at the point of removal to insure against a reattachment.

It is reported that the wireless station at Cocos Island which was destroyed by the German cruiser Emden, is again in operation.

## SIGNALLING CORPS ON MOTORCYCLES

Arrangements are being made for the organization of a motorcycle corps to be added to the Thirteeenth Regiment, Coast Artillery. It is intended to have the corps composed of twenty-four enlisted men who will be trained in all kinds of signalling, such as heliographing, searchlight, acetylene, wireless, ardois and wigwagging. The reason for mounting the men on motorcycles is because of the considerable distances that may have to be covered in reaching the various coast batteries.

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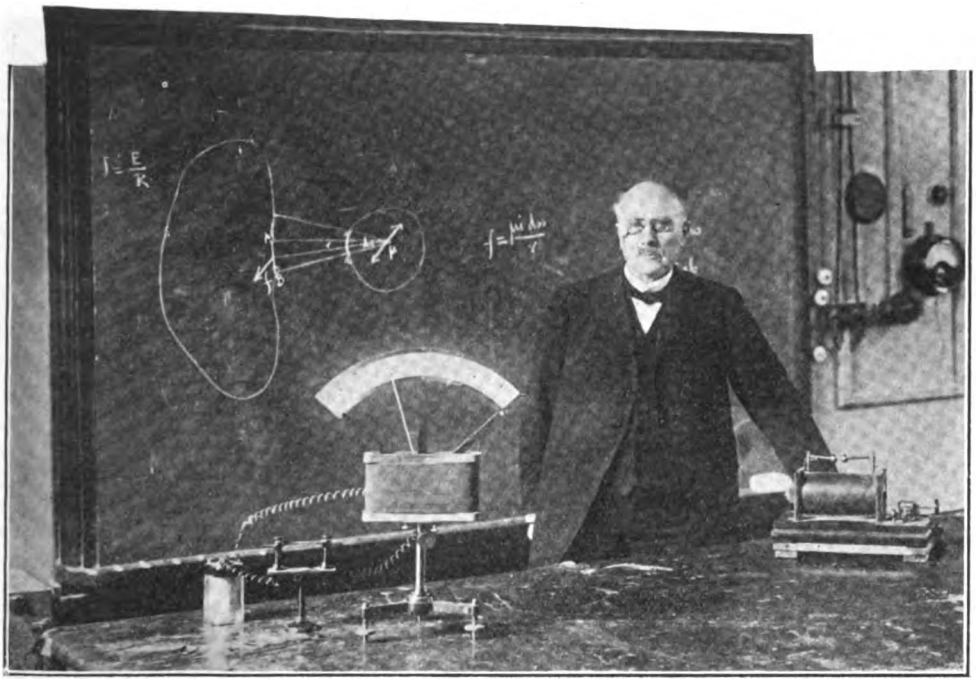
# Those Wireless Bomb-Exploding Devices

## What An Authority Thinks of Inventors' Claims



*Dr. Edouard Branly*

IT is just possible that gullible newspapers and pseudo-scientific journals will now drop a certain type of story which has been bobbing up serenely on an average of once a month over a period of some three years. That is the bomb-exploding-by-wireless inventor who has just devised a death dealing machine that with fiendish glee will sink all the navies afloat. You know the yarn: Ezra Dogstory, who has devoted a lifetime, etc., etc., demonstrates in an open field how explosions can be directed by the insidious wireless spark. The great principles discovered by Ezra are to be applied to the destruction of mighty vessels and impregnable fortresses, the crafty spark being propagated from great distances and directed with unerring accuracy to the powder magazines of said armaments. Of course the government alone shall have the benefit of Erga's great discovery, he is not seeking financial reward, it is the greatest pleasure of his life to be of service to his country—and so on. With photos of the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genius in picturesque and unassuming poses, the story invariably looks good to the City Desk.

But Ezra's nice little publicity dodge, good for publication in five languages, will serve no longer.

No less an authority than Dr. Edouard Branly says what these self-confessed inventors purpose doing is an impossibility. And for those who don't know Dr. Branly, it may be mentioned that he is the inventor of the "coherer" which was featured so prominently in the reception of wireless signals in the early days of the art. Besides this, Dr. Branly has the degrees of Doctor of Physical Science and Doctor of Medicine; he received for his exhibit of radio-conductors the *grand prix* awarded by the International Jury of Superior Precept Instruction, and the order, Chevalier of the Legion of Honor, for his valued aid in the discovery of wireless telegraphy. Many other French honors have come to Dr. Branly in the 71 years of his lifetime, but those just detailed are sufficient to establish his standing with wireless men. Next time the obscure bomb-exploding inventor breaks into print, recall what the voice speaking with authority remarks here:

"The human species," Dr. Branly says, "is paying a sufficiently large tribute to science in this war; it is scarcely worth while to discuss the visionary powers that are attributed to it. It has increased the flow of blood and the enormity of ruins, making international conflicts more horrifying, but there are things it cannot accomplish, unfortunately. Science sends the Lusitania to the bottom of the Atlantic with more than a thousand human souls, but it is powerless, contrary to some pretensions, to cause the destruction at a distance by electric current of the engine which by the will of man caused a disaster hitherto reserved to the wrath of the elements. Neither can it reach by radiating waves the destructive engines of the air.

"The false notion of those who pretend to transmit destructive power through space arises from the fact that wireless telegraphy is accomplished through the production of a minuscule spark at the receiving station. That spark being sufficient to produce an effect upon extremely sensitive instruments at great distance, they concluded that at a limited distance, of a mile for instance, a much stronger spark could be produced; as that spark is supposed to go through all sorts of obstacles they inferred that it could also pierce the steel shell of engines of war. In the first place no available power could produce a spark of sufficient intensity; there isn't the slightest caloric power in the wireless spark at the receiving end. In the second place it would be necessary for it to strike with absolute precision a joint or fissure in the plates in order to get into contact with the explosive. Different accidents erroneously attributed to the wireless current may have put some of these visionaries on this track. It was discussed whether the Volturno was not fired at sea and if the explosion of the French battleship Jena at Toulon was not provoked by wireless sparks.

"The Eiffel Tower wireless transmitting station produces most formidable sparks, yet not the slightest accident has ever been caused in the vicinity. To produce explosions at a distance something different from wireless electric currents must be found. Most of the inventions for this purpose that have come to my notice when thoroughly investigated were found to be connected with concealed clockwork, and in no case when powder was brought in by disinterested parties were they able to provoke an explosion.

"There are a great many 'chevaliers d'industrie,' or what you might call confidence men, in English, who have not hesitated to make profit out of the tension of the public mind by exploiting pretended inventions of this kind, but no scientist worthy of the name makes such pretensions. If there were means of blowing up the Eiffel Tower from Berlin everyone would know it, yet people are frequently swindled by supposed appliances for transmitting energy—even available for industrial enterprises, without a conductor. They all want a great deal of money; one asked for the modest sum of 28,000,000 francs. One man who made the mistake of consulting me afterward instead of before, paid 200,000 francs for an interest in an invention of this kind."

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# Radio Frequency Changers*

By Alfred N. Goldsmith, Ph.D.

## Part II (Conclusion)

WE pass to the methods of frequency change involving the use of electrolytic cell rectifiers. If we study the behavior of an electrolytic cell employing a solution of alum as the electrolyte and carbon and aluminum as the electrodes, we discover that it permits the passage through it of current only in one direction, namely, from the aluminum to the carbon. In Fig. 9 is shown an application of such a cell to a frequency changer. $V_1$ and $V_2$ are two such electrolytic cells; and $S_1$ and $S_2$ are the primaries of two transformers of which S' and S" are the secondaries. It will be noticed that $V_1$ and $V_2$ are connected with opposite polarity in their respective

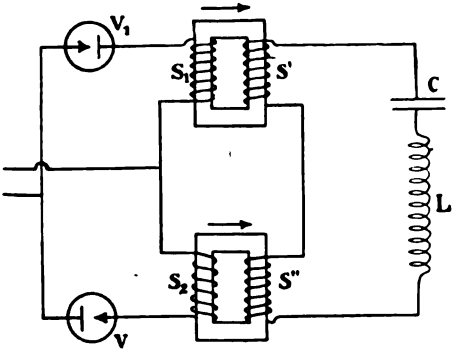


*Fig. 9*

circuits, and that in consequence current can flow through $S_1$ only in one direction and through $S_2$ in the opposite direction. Furthermore, coil $S_1$ is wound in the opposite direction to coil $S_2$. On the other hand, S' and S" are wound in the same direction. In Fig. 10, curve a shows the current passing through $S_1$, and the consequent magnetic flux through the corresponding transformer core. Curve b shows similarly the induction in the core of the second transformer. The total magnetic induction for both transformers is shown in curve c. It will be seen

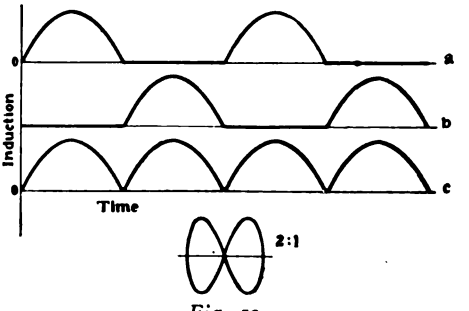


*Fig. 10*

that during the time of a single alternation of the supply current there are two maxima and two minima of the magnetic induction in the transformer cores. It is therefore clear that there will be produced in the circuit containing the two secondaries a current of double frequency although the wave form of this current will be noticeably distorted in view of the non-sinusoidal character of the magnetic induction.

If it is desired to draw any appreciable amount of energy from the frequency changer, the inductance L and the capacity C are connected in series with the two secondaries, thereby bringing that circuit to resonance with the double frequency. Zenneck has done a considerable amount of valuable work along these lines and has found these cells to be usable at radio frequencies. However, the passage through them of considerable energy is attended with certain difficulties based on excessive heating and deterioration of the electrodes. Using a cell having lead and aluminum electrodes

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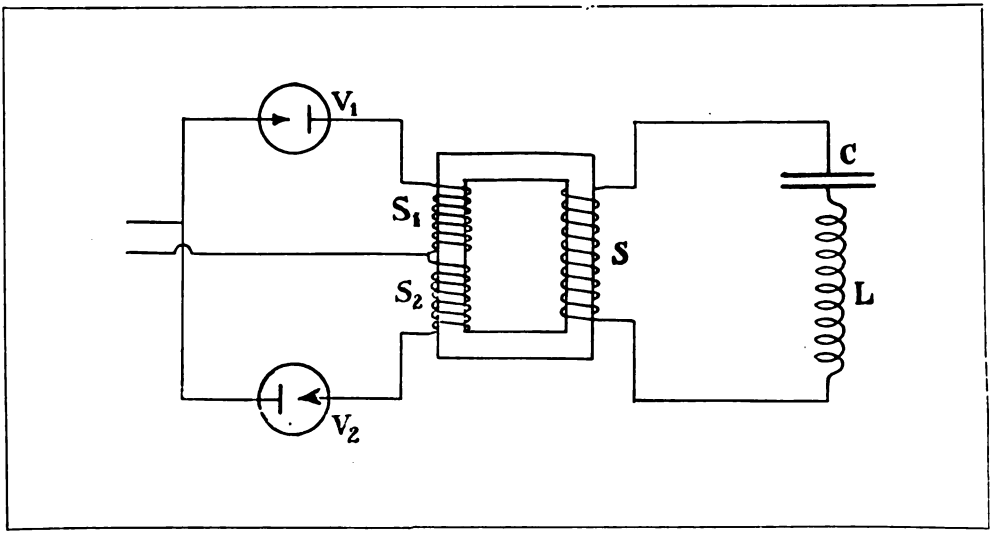


*Fig. 11*

in a 5 per cent. solution of ammonium phosphate, Zenneck has demonstrated the production of the double frequency in an admirably clear way by the Lissajous figures. A Braun tube oscillograph was employed. Near the cathode stream were placed two mutually perpendicular coils, one of which was connected to the primary circuit of the frequency transformer and the other to the secondary circuit thereof. The familiar Lissajous "figure of eight," which signifies a ratio of frequencies of two to one, immediately appeared on the screen (Fig. 10).

Among the other circuit arrangements suggested by Zenneck are those shown in Figs. 11 and 12. In Fig. 11 only a single transformer is used, and in spite of the interaction between $S_1$ and $S_2$ in that case, a double frequency secondary current is obtained. In Fig. 12 a transformer with but a single winding on both primary and secondary is employed. The current path during a half cycle in this case is through the path $V_2S_1V_3$. During the second path of the cycle the current path is $V_1S_1V_4$.

Continuing the consideration of frequency changes without moving parts, we come to a method for tripling the frequency directly by taking advantage of certain characteristics of an ordinary alternating current arc. It is well known that the potential difference at the terminals of an alternating current arc may have the form shown in Fig. 13. So greatly deformed a wave form naturally suggests the existence of strong upper harmonics. It is in fact found that if we decompose this curve into component waves of the fundamental and other frequencies, the third harmonic is very prominent. In Fig. 14, curve *a* represents fairly accurately the potential difference at the terminals of the arc. Curve *b* shows one of its components; namely, that of the fundamental frequency. Curve *c* shows the component of triple frequency; in fact, curve *a* is merely the sum of curves *b* and *c*. A circuit arrangement which can be employed to advantage under these conditions is given in Fig. 15. The circuit L C is tuned to the triple frequency, and the inductances D prevent to a certain extent the triple frequency current from getting back to the alternator. The arrangement shown further permits obtaining the fifth, seventh, ninth and so on, frequencies, provided the circuit L C is tuned to the appropriate frequency. In fact, Rukop and Zenneck have done considerable work for the case where the frequency of the circuit L C was 300 times the fundamental frequency. For details of this investigation, the reader is referred to their article in "Annalen der Physik," 1914, Volume 44, page 97.

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We consider now the extremely important cases wherein stationary frequency changers are employed, their operation being dependent on electromagnetic induction and the peculiar properties of iron. In Fig. 16, is shown a typical B-H (magnetizing force-induction) curve for iron. Let us suppose that the magnetization of the iron has been brought to the point x. If now, by means of a superposed alternating magnetizing force, equal increments and decrements be added to the magnetizing force, the magnetic induction will increase during the positive half of the cycle by the small amount e f. On the other hand, during the negative half of the cycle, the induction will diminish by the considerably larger amount x d. The explanation of this phenomena is to be found in the well known magnetic saturation qualities of iron. In other words, a marked deformation from a sinusoidal variation of magnetic induction will occur when nearly saturated iron cores are employed. Such a deformation always leads to the production of upper harmonics, and it is upon this principle that the entire series of frequency changers employing iron is based.

A modification of the method just mentioned, and one of a highly ingenious sort, has been devised by Dr. R. Goldschmidt. It will be remembered that Rutherford first showed that remanent magnetism in iron could be destroyed by an alternating current field of high frequency. Furthermore, the hysteresis loop of iron for a magnetic cycle is much diminished in area if the iron is at the same time placed in a weak high frequency field.

Consequently it follows that if a piece of iron be magnetized longitudinally by a direct current field and transversely by an alternating current field, any slow variations in the direct current field will show only small hysteresis effect. A rough physical explanation of this phenomena is given by the consideration that the transverse magnetization keeps the elementary magnets of the iron in a mobile condition and thereby permits the longitudinal field to control them accurately and instantaneously. The large "static friction" between them is replaced by a much smaller "dynamic friction." Furthermore, if a direct current transverse field be employed, the effective permeability of the iron for the longitudinal magnetization will be diminished, and the hysteresis loop therefor will be changed in slope. We have here the interesting situation that two mutually perpendicular coils may react on each other through the influence of the medium between them, and in spite of their apparent zero mutual inductance.

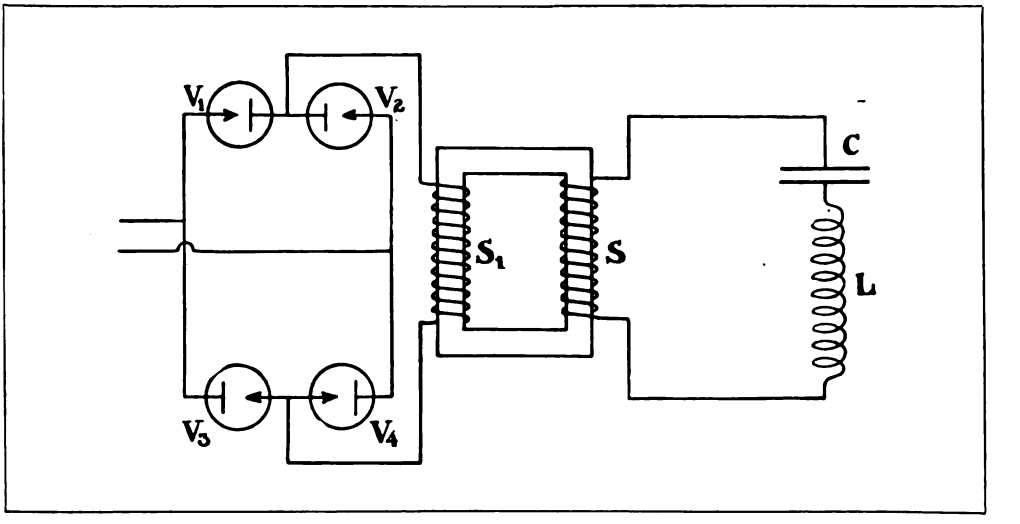


*Fig. 12*

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The arrangement used by Goldschmidt is given in Fig. 17. The iron tube r is magnetized longitudinally (axially) by means of the coil *a* and is magnetized transversely by means of the coil *b*. If the longitudinal magnetization is produced by direct current and the transverse magnetization by alternating current, both the positive and the negative maxima of the alternating transverse field will cause minima in the strength of the longitudinal field. These variations in the longitudinal field have, therefore, a frequency which is twice that of the alternating current supplied to the transverse field.

If now we connect across the terminals of coil *a* a condenser, whereby coil *a* and the condenser are resonant to the double frequency, and if we simultaneously place in the large choke coils direct current supply lines to the coil *a* to prevent alternating current getting back to the direct current source, we shall be able to draw considerable amounts of double frequency energy from the terminals of coil *a*.

By a further artifice we may carry the process of frequency transformation forward any desired number of steps. If we have a direct current as well as an alternating current flowing in the transverse magnetizing coil *b*, the double frequency current in coil *a* will produce a quadruple frequency current in coil *b*. The next step will give us a current of eight times the fundamental frequency in coil *a*, and the process may be continued through any desired number of steps. Any of the upper frequencies may be brought to resonance and energy absorbed at that frequency by appropriate tuning. The limitations of the process as to energy output are based on the small amount of iron which is available in any arrangement of this sort and the consequent overloading thereof.

The method next described was shown by Epstein in 1902 (German patent 149,761), and has since been worked out and amplified in detail by Joly in 1910, and by Vallauri in 1911. The circuit arrangement employed is shown in Figure 18. As will be seen, an alternating current source A sends its current through the primary $P_1$ $P_2$ of two transformers. These primaries may be either connected in series or in parallel. They are wound oppositely. A direct current source B supplies two auxiliary coils $M_1$ $M_2$, which coils are wound on the transformer cores. These direct current coils are also wound oppositely. The secondaries of the transformers $S_1$ $S_2$ are wound in the same direction and connected as shown.

The operation of this device is as follows: The direct current magnetization of each of the transformer cores is such that it is working at the knee of the magnetization curve. If we consider Figure 19, curve a, we shall have a representation of the varying magnetic flux or induction in one of the transformers.

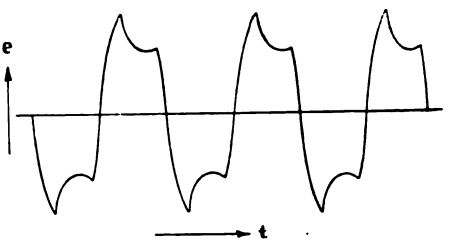


*Fig. 13*

The dotted horizontal line represents the constant direct current induction, the full line represents the resulting induction. It will be seen that when the positive half of the alternating current cycle is taking place, there is only a small increase in the magnetic induction, whereas when the negative half cycle is taking place, there is a large diminution in the induction. It will be noticed that the direct current coils and the alternating current coils on the two transformers are wound so that during the positive half cycle they assist each other on one transformer and oppose each other on the other. From this it follows that the induction in the second transformer is given by curve b, which lags practically 180 degrees behind curve a. The resulting total induction is given by curve c, and is seen to have a double frequency. In Figure 20, oscilligrams of the phenomena mentioned are shown. The voltage at the terminals at one of the transformers is given by $E_1$; that at the ter-

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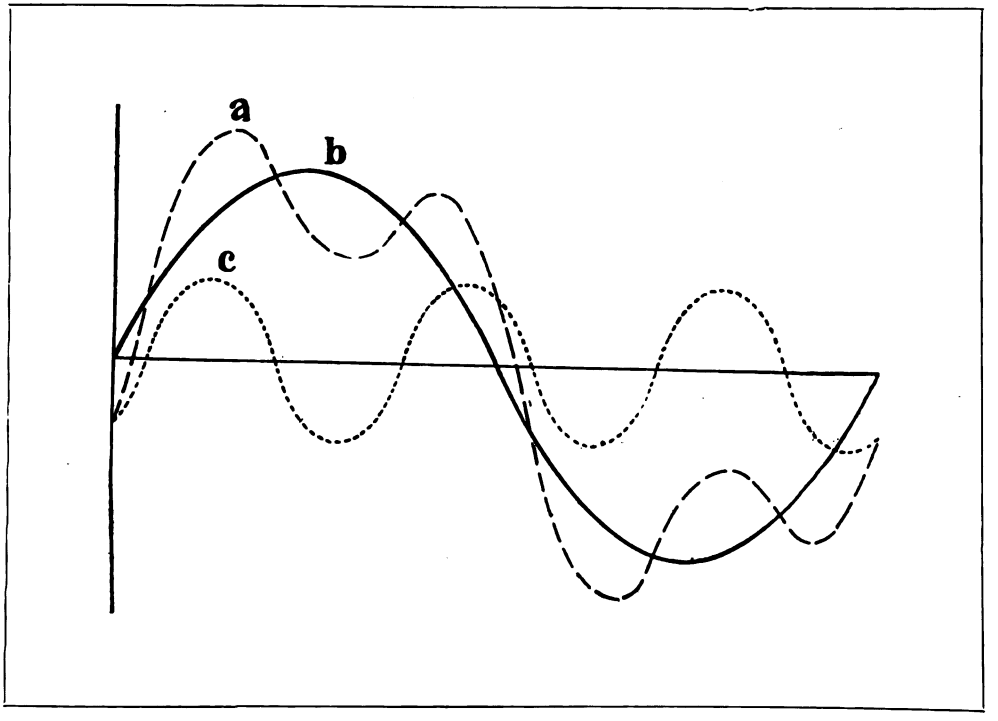


*Fig. 14*

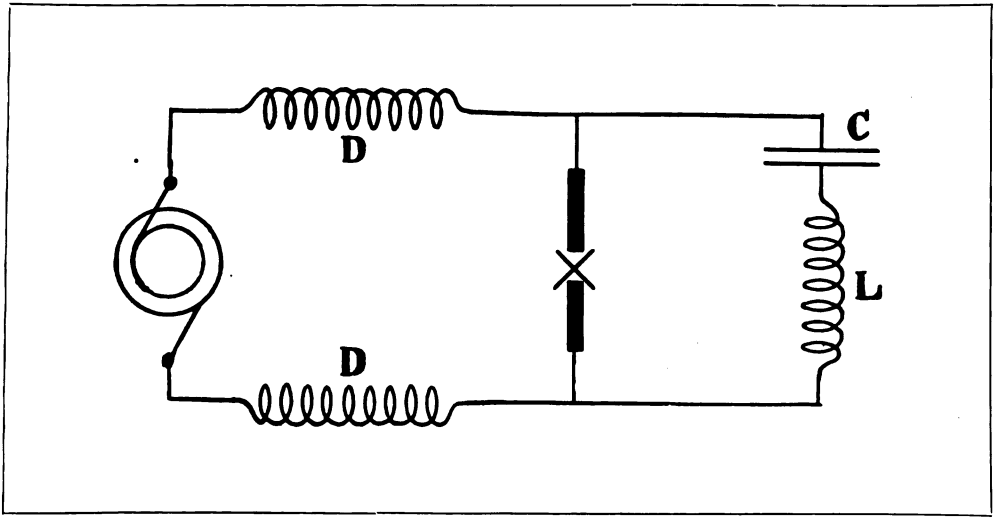


*Fig. 15*

minals of the other transformer by $E_2$, and there is also shown the resultant voltage, namely $E_1$-$E_2$. This latter is seen to be of double frequency.

A simplified modification of the circuits shown is given by Vallauri, and is illustrated in Figure 21. It will be seen that only a single transformer is used, and that a special small auxiliary transformer T is employed, whereby the dou-

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ble frequency alternating current which is induced in the direct current circuit is neutralized and suppressed. All the arrangements described are readily adaptable to use with two phase and polyphase currents. Some interesting data is given by the inventor. Using a 0.5 kilowatt transformer without tuning capacity, and with fairly large leakage, an efficiency of 0.75 was obtained. It was possible to increase this efficiency still further by making the alteration in flux density considerably larger than in the usual transformer. In all frequency changers of this type, the secondary voltage leads the primary current considerably, and the device works at a low power factor; say under 0.5.

Joly has described a method for directly tripling the frequency, using iron core transformers. It depends upon the following principles. If we send an alternating current through the primary of a transformer, and arrange that at the maximum current point of the cycle the iron core shall still be working far below saturation, the induction curve will be a peaked curve such as is shown in curve c of Figure 22. On the other hand if we work the iron at saturation value for the maximum current point of the cycle, we shall obtain a very flat-topped induction curve as shown by curve b of the same figure. If two such primaries, of the classes mentioned, are connected in series in opposite directions on two trans-

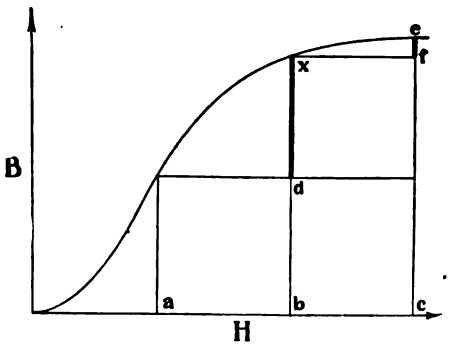


Fig. 16

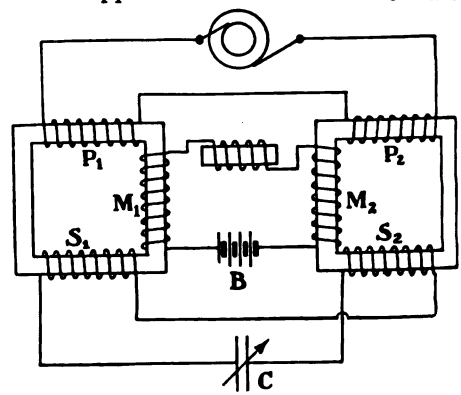


Fig. 18

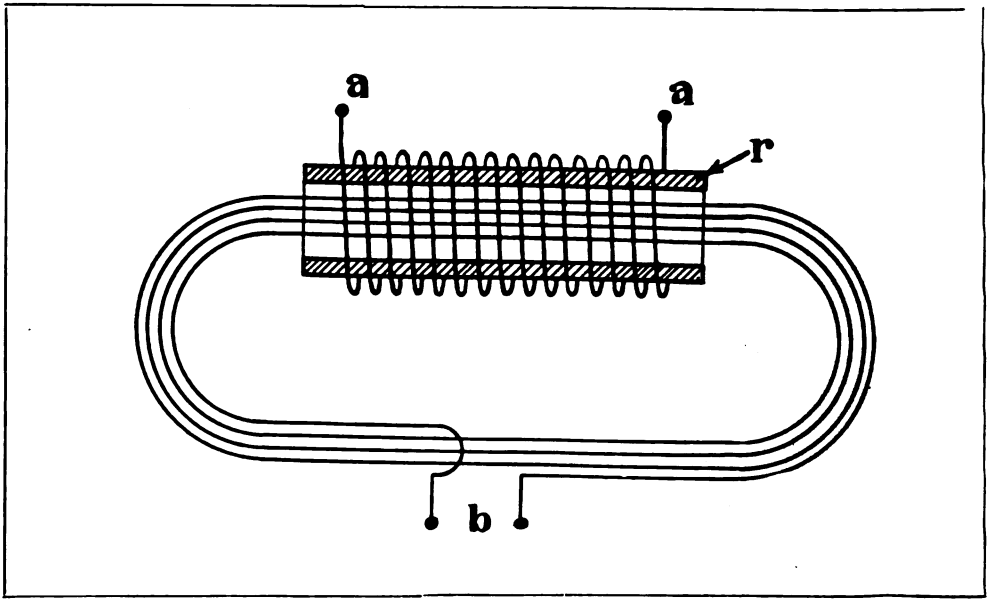


Fig. 17

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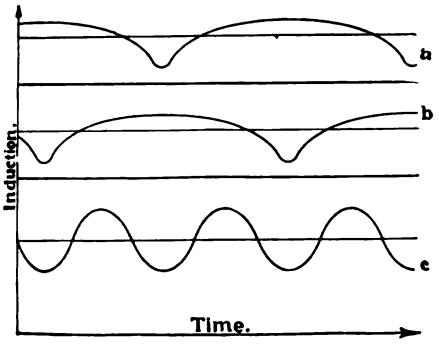


*Fig. 19*

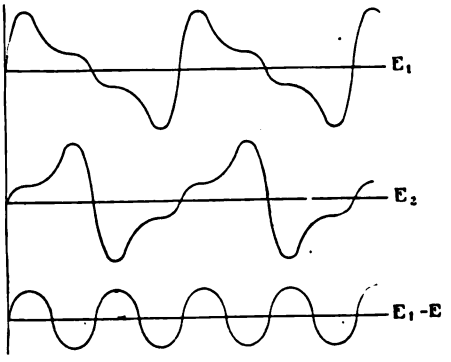


*Fig. 20*

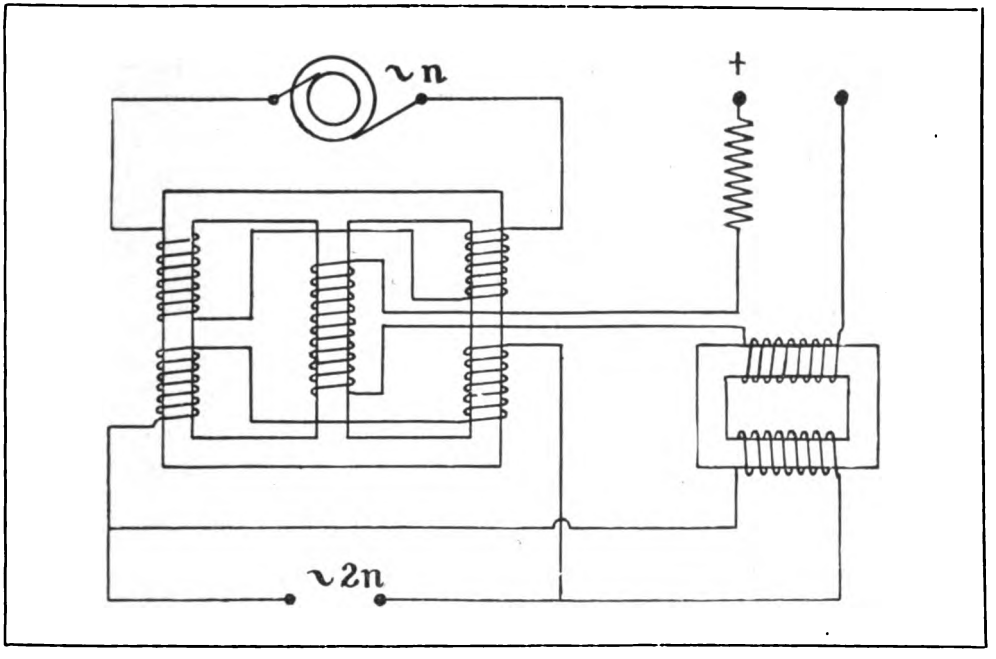


*Fig. 21*

formers, as shown by $S_1$ $S_2$ of Figure 23, the resulting secondary electromotive force will be of triple frequency. This is clearly seen from curve d in Figure 22, which curve represents the difference of the two induction curves in the separate transformer. It will be noted that the secondaries, S′ and S″, are wound with appropriate numbers of turns, so as to compensate for the inequalities in the number of turns of $S_1$ and $S_2$. Furthermore the secondary circuit is carefully tuned to the triple frequency. Needless to say a very rapid multiplication of frequency can be obtained by this method. For example, the frequency can be raised 81 times in only 4 steps. In the foregoing, the author has utilized among many other sources, discussions on the subject of radio frequency generation and multiplication by Professor B. Glatzel and Dr. F. Kock.

It is our belief that the most fruitful results in the field of radio telephony

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may well be obtainable by the use of one or the other of the frequency changers which have been herein described. One of the difficulties in practical long distance radio telephony, and it is a very serious difficulty, is the control or modulation to speech form of the outgoing energy by an ordinary microphone transmitter. Up to the present time, it has not been possible to replace the ordinary

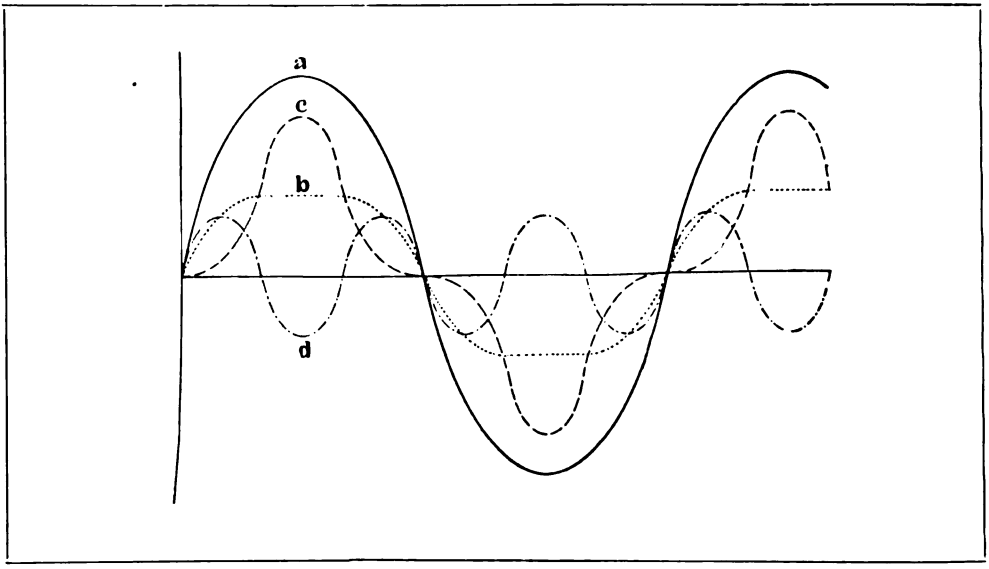


*Fig. 22*

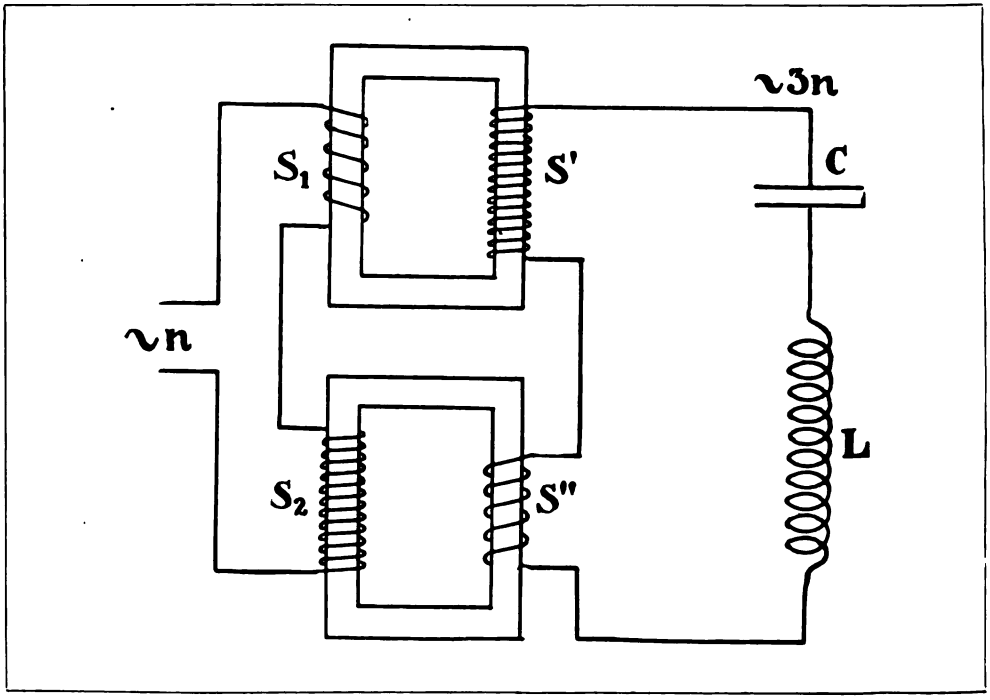


*Fig. 23*

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transmitter by any simple and at the same time reliable device. We are, therefore, driven to use some method of trigger control whereby small changes in the resistance of the microphone transmitter, such as are caused by speech, will produce proportionate but highly magnified change in the amount of radiated energy. The various frequency changers described lend themselves admirably to different forms of trigger control of output. For example, many of them are very sensitive to a small change in tuning in one of the intermediate steps. If, therefore, we shunt one of the tuning condensers in the iron core type of frequency changer by either one or more microphones, we are given a ready means of controlling the output to a certain extent. Still another possibility is given in some of these types of transformers just described if we cause the microphone to vary the direct current magnetization which brings the iron cores to the saturation point. Since the proper operation of the Joly frequency transformer is largely dependent on an accurate adjustment of the core magnetization, it is clear that microphone control thereof should be successful in practice.

It seems to the writer that the apparent trend of high power radio design is in the direction of the moderately high or even radio frequency alternator, employed in conjunction with one or more of the frequency changers. So far as radio telephony is concerned, this direction of development should be highly favorable to success.

## Another Route to the Valley of the Yenesei

Pressed by the urgent need to develop the immense resources of timber, minerals and foodstuffs which lie unused in the vast district between Lake Bikal and the Ural Mountains, the Russian government has established a line of wireless stations to make possible navigation to the mouths of the Ob and Yenesei. The steamship route from Tromsoe, Norway, to the Yenesei runs through the Arctic Ocean eastward to Vaigatch Island, which blocks the pass between Nova Zembla and the mainland, thence through the straits north or south into the desolate, ice-swept Kara Sea, where, to the eastward, lie the rivers that flow out from Mongolia. Steamships only can move freight from this land-locked territory—the cost of railroad transportation is prohibitive. Two years ago the 2,000-mile run from Tromsoe required twenty-three days; now the round trip can be made in nineteen days, thanks to the wireless.

Two of the three radio stations command the straits west of the Kara Sea. One is located on the island of Vaigatch to cover the Kara Strait to the north; the other, from Yugorski, guards the Jugor Strait to the southward, while the third lies at Cape Mara Sale on the mainland on the eastern shore of the Kara Sea. These stations observe the movements of the summer floe and warn vessels of the presence of dangerous ice. Later, with the assistance of fast sea planes, they will be able to follow the movements of the ever-changing lanes and channels, through which Nansen picked his way to the "farthest north" aboard the staunch Fram. Nansen himself assisted in establishing the route and the Fram carried the party.

## Wireless Aids Storm-Bound Trains

The value of wireless in railroading was driven home during a recent blizzard. After the wires had been blown down on the Delaware, Lackawanna and Western Railroad, the Marconi wireless equipment was employed for train despatching, the Hoboken (N. J.) tower keeping in communication with snow-bound trains.

A wireless station was recently erected at St. Lucia, the West Indies.

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# A Trip to Sayville

**Being the Record of the Momentous Pilgrimage of Chris. M. Bowman, Wireless Enthusiast**

WHEN you purchase your ticket to Sayville and return, the Long Island Railroad's ticket-man will, on request, give you a schedule which purports to carry on one side a map of Long Island. What you haven't learned up to this point about the geographical location of Sayville will, even with the aid of the map, still remain enshrouded in mystery.

But having abounding faith that the train has a definite acquaintance with your destination, you suffer yourself to experience a breath-taking rush through the East River Tubes, followed by an interesting dash by many factories and a sudden entrance into the well-kept truck farming sections. Then come the commuters' towns in great numbers, heralded by scores of inviting signboards. You are surprised at the allurements these hold forth, so you turn to the passenger who shares your seat and inquire: "How can these houses and lots be so cheap, yet so near New York?" The answer is returned in one word: "Mosquitos!"

About half-way into the second hour the train draws up at Sayville. Of course you have been sitting on the right hand side, since nobody told you not to, and as you alight your first question is concerned with the whereabouts of the wireless station. You are advised to look up the railroad in the direction you have just come, whereupon you see three giant spires rising half a thousand feet in the air. This, then, is your first glimpse of the great WSL station you have so often heard in your own 'phones at home.

Soon after you reach the great station. Its new system of eleven great towers covers a tract of half-mile square and encircling the property is a wire fence. Just back of this are many impressive "Danger" signs.

Upon the gate posts, scrawled in pencil is the old slogan: "Hoch der Kaiser," and below it are the signatures of various Karls, Hanses and Heinrichs.

Just back of the gate stands a little shed, for all the world like a sentry box, sheltering a true son of the Fatherland who promptly but courteously inquires your business in a broken German accent. There are a number of these lookouts posted throughout the day, and five of them at night. They are not U. S. Government men, but are employed by the Atlantic Communication Co. These watchmen, with true German industry, seem to keep the idle moments occupied, as attractive little flower gardens are seen about their sheds.

You may have come with a letter of introduction from the Governor of your State, also one from your Congressman, both personally acquainted with the high-


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est naval authorities in charge; but these will profit you little, as far as seeing into the innermost portals is concerned. You are kindly but firmly informed that at such times as these, it is necessary to have a personal permit from the Secretary of the Navy himself, as well as one from the Atlantic Communication Co., the owners, and signed by Mr. Boehme personally. It is needless to say neither of these are to be found about your person. If you are fortunate, however, you will meet Lieutenant Clark, in charge, who is very interesting and courteous.

The operating buildings, the great concrete guy-anchors, the original mast of the old station, the new steel masts with their peculiar spiral construction, five hundred feet high, and terminating in a point below, the complicated aerial system, extending to the eleven masts embracing the new station, the tents of the U. S. Navy Censors, all furnish a picturesque and interesting sight, well worth the trip to Sayville.

But Young America desirous of visiting the German station, hoping to get an opportunity to "listen in" to just hit off a dot or dash or two on her key, or have a look at the new 100 k. w. continuous wave transmitter, will be sadly disappointed. The several dollars' carfare charged to Sayville will be better invested in apparatus to improve those smaller stations at home.

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# "Without Friends No One Would Choose to Live"—*Aristotle*

I am very well pleased with THE WIRELESS AGE and would not be without it. I shall tell everyone I know about it.—C. A. H., *Connecticut.*

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September "AGE" arrived to-day, and I must say it's fine.—*K. B. W., Illinois.*

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THE WIRELESS AGE is THE radio magazine.—H. T. B., *Pennsylvania.*

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THE WIRELESS AGE gets better and better.—*C. O. A., Michigan.*

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I cannot get along without it even for one month, so I am sending you my subscription to it for another year.—E. G. R., *New Jersey.*

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THE WIRELESS AGE is the best *wireless* magazine I have ever read. I advise everyone who wishes to study wireless from a technical standpoint to read THE WIRELESS AGE.—H. W. T., *Pennsylvania.*

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I am very much pleased with THE WIRELESS AGE and consider it second to no other magazine or paper in the wireless field.—F. C. E., *Massachusetts.*

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Like many others, I cannot afford to be without current issues of THE WIRELESS AGE.—J. N. B., *New York.*

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I could not afford to lose a single number of your magazine. I have all back numbers to October, 1913 and would not part with them for anything. They form a reference library that can't be beat.—F. C. M., *Louisiana.*

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I wish to state to you my admiration for your magazine and wish to say that I am a subscriber and it is the best paper of its kind on the market.—F. J. S., *New Jersey.*

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# How to Conduct a Radio Club

## General Advice on Communication Between Amateur Radio Stations

Specially Prepared for the National Amateur Wireless Association

By Elmer E. Bucher

**Article XIX**

AN outstanding problem of amateur radio associations is the establishment of wireless telegraph communication between club or privately-owned stations located in widely separated districts. One of the factors entering into the question is the 200-meter wave which restricts the capacity of the condenser in the closed oscillatory circuit, permitting no more than ¼ to ½ k.w. consumption of energy when the transmitter is operated from a sixty-cycle source of current supply. Increased primary input can be obtained by the use of 500-cycle current, but since the average amateur station cannot avail itself of energy at this frequency, commercial frequencies must be resorted to and a high spark note obtained by the use of a non-synchronous rotary gap.

In view of the fact that the usual amateur aerial, excited by sixty-cycle apparatus and operated in full compliance with the United States restrictions, does not have more than one or two amperes of current in the antenna system, and, furthermore, keeping in mind the fact that the maximum efficiency of the modern radiating aerial seems to have been attained, it is necessary to look in another direction for the solution of the problem. The search naturally leads to the receiving apparatus which, within the past several months, has attained such a remarkable degree of sensibility as to suggest new possibilities in amateur radio communication.

The statements regarding the limited distances that can be covered do not apply to the amateur station located far from the zone of commercial interference, for in that case the United States authorities will allow a license for increased wave-lengths, thereby permitting the use of increased primary power. In an instance of this kind a 1 or 2 k.w. set operated at a wave-length of, say, 600 meters, is recommended, although it might prove more desirable to employ a wave-length of 450 meters to avoid the setting up of interference with commercial radio stations. At night-time, during the favorable months of the year, apparatus of this capacity can transmit 1,000 or more miles over land, thus making amateur intercommunication a solid fact rather than mere fancy.

The amateur station restricted to the 200-meter wave often does not attain the maximum possible range owing to improper design of the circuits of radio frequency. Frequently these circuits represent an undesirable value of high frequency-resistance, mainly due to the use of copper conductors in the circuits which have insufficient capacity for the heavy effective value of current flowing. A second error is lack of resonance between the open and closed oscillatory circuits, or an excessive value of coupling.

A somewhat positive indication of improper design of the radio frequency circuits is the action of the hot wire aerial ammeter when the transmitting


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key is depressed. If a large change of inductance is required in either circuit to effect an increase or decrease of antenna current, it may be considered a manifestation of dissonance, i.e., forced oscillations, or perhaps excessive damping in the circuits. In the antenna system the latter effect may be due to an imperfect earth connection or perhaps leakage at the aerial insulators. In the closed circuit an excessive value of secondary voltage may require a spark gap of abnormal length. Again, there may be losses in the condenser, such as brush discharge or dielectric losses by direct conduction through the insulating medium. Occasionally the spark discharge assumes the nature of an arc which is bound to result in imperfect oscillations.

Let the reader, then, give his attention to a transmitting apparatus possessing the features of an efficient amateur equipment. For the 200-meter wave the dimensions of the aerial must be kept within certain limits. If of the inverted L type, consisting of four wires, spaced two feet apart, the flat top portion should not exceed 60 feet in length, and the height should not be more than 40 feet. An aerial of these dimensions possesses a fundamental wave-length of about 160 or 170 meters, but when the secondary winding of the transmitting oscillation transformer is connected in series, the wave-length will be raised to normal value. Other aerials having the same fundamental wave-length should be constructed as follows: The flat top portion may be 50 feet in length by 40 feet in height, of 70 feet in length by 30 feet in height.

The apparatus of this station should include a ½ k.w. sixty-cycle transformer with a secondary voltage of from 15,000 to 20,000 volts. It may be of the open or closed type. If of the latter type it should be fitted with a magnetic leakage gap. A condenser, to be operated on the 200-meter wave suitable for this transformer, can in no case exceed .01 microfarad capacity. In the event that one of this value is employed the connecting leads to the spark gap and primary winding of the oscillation transformer must be extremely short. It might, therefore, be more desirable to reduce the capacity of the condenser to .008 microfarad, allowing the use of longer connecting wires or perhaps additional turns at the primary winding of the oscillation transformer. To a certain extent oil condensers are practical, but in the event of puncture they are undesirable for obvious reasons. In commercial stations the copper plated leyden jar is the order of the day and the amateur experimenter will do well to follow the set example. A second essential in the transmitting condenser is the use of a good grade of glass which should be free from lead or other metallic substances to avoid leakage. The plates of the condenser should be not less than ⅛ of an inch in thickness.

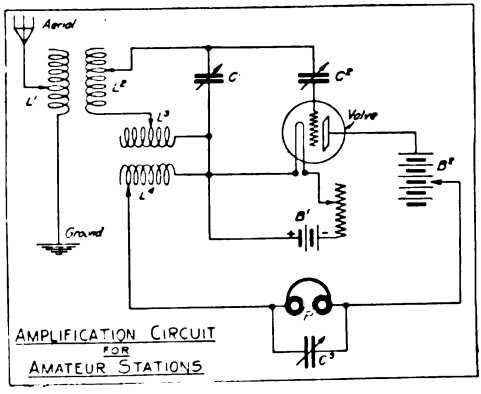


*Fig. 1*

The oscillation transformer may be of the helix or flat spiral type. Care should be taken that the adjacent turns are sufficiently spaced to prevent sparking between them. It makes no difference whether this transformer is constructed of brass, or copper ribbon, or of stranded D.B.R.C. wire, provided there is sufficient conductivity to take care of the current.

To secure a spark note of musical characteristic, the transmitting set should be fitted with a rotary gap having a disc approximately 8 inches in diameter. It should be fitted with eight or ten discharge electrodes re-

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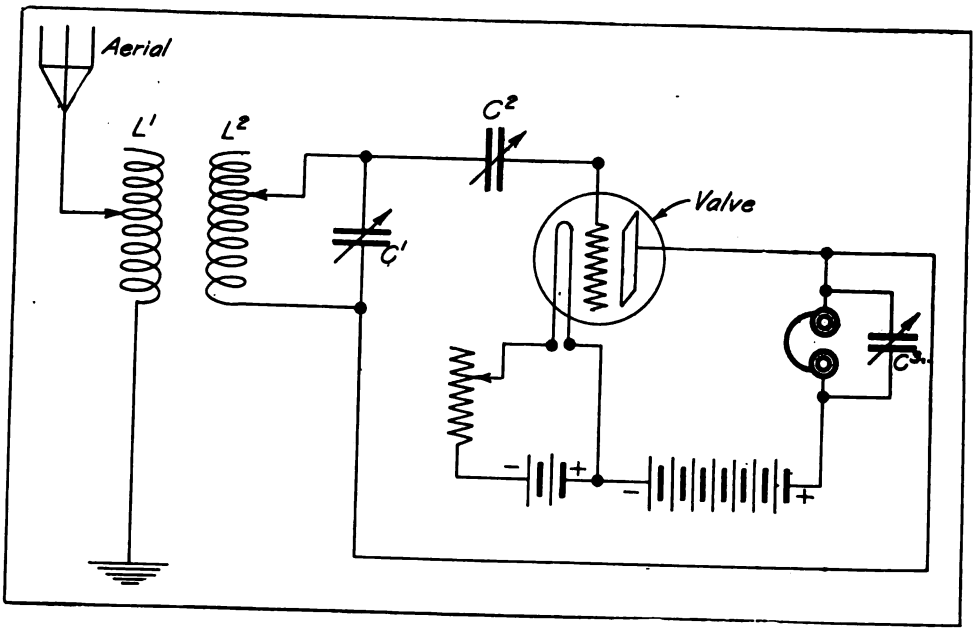


*Fig. 2*

volving at a speed of from 2,400 to 3,000 R.P.M. By experiment it is not found advisable with a sixty-cycle source of current supply to produce more than 300 to 400 spark discharges per second. Hence no advantage is derived in excessive disc speed; in addition, a desirable factor of safety is introduced at the lower speed.

The apparatus referred to must be mounted compactly, the component parts of the radio frequency circuits comprising the condenser, the spark gap and the oscillation transformer being connected together with excessively short leads; otherwise the wavelength of the spark gap circuit may be in excess of the United States restriction. The foregoing statements should receive careful consideration because the adoption of equipment constructed according to the directions given will insure success at the outset.

Receiving apparatus which will increase the range of the average amateur station comes next in the order of discussion. Remarkable developments in this respect have taken place during the last few years; in fact amplification circuits have been evolved which permit most unusual distances to be covered. A particular circuit of this type described in certain United States patents is shown in Fig. 1 where the incoming signals on a single vacuum valve detector are repeated back to the secondary or grid circuit and considerably amplified. Although applicable to longer wave-lengths, good results have been obtained on the 600-meter wave when the coils of Fig. 1 have the following dimensions: The primary winding of the oscillation transformer, L-1, is 4¾ inches in length by 4 inches in diameter, wound closely with No. 26 S.S.C. wire. The coil, L-2, the secondary winding of the oscillation transformer, is 5 inches in length by 3⅜ inches in diameter, wound closely with No. 30 S.S.C. wire. The coil, L-3, the secondary winding for the coil, L-4, may be 5 inches in length by 4 inches in diameter, wound closely with No. 26 S.S.C. wire. The coil, L-4, is constructed so that it may be telescoped inside of L-3, i.e., placed in variable inductive relation. L-4 is 4½ inches in length by 4 inches in diameter, wound closely with No. 26 S.S.C. wire.

The complete circuit further includes

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the condenser, C-1, the maximum value of which need not exceed .0005 microfarad. The condenser, C-2, is one of small capacity, not more than .0001 microfarad, and in place of the ordinary small variable condenser two concentric brass tubes of very small dimensions may be employed. The condenser, C-3, connected in shunt to the head telephones, P, should have a maximum value of .001 microfarad.

For the most sensitive operating conditions, the primary and secondary windings of the receiving transformer should be adjusted to resonance and to the incoming wave. The procedure of course involves careful adjustment of the filament voltage and also of the high potential battery, B-2, connected in series with the head telephones. The foregoing adjustments are followed by a certain critical degree of coupling between the coils, L-3 and L-4, and corresponding variations of the capacity of the condenser, C-3. When the proper values are selected throughout considerable amplification of the received signals is obtained, often from ten to fifty times the intensity possible with ordinary circuits. If the circuit lacks proper adjustment, hissing tones which interfere with the reception of signals will be produced, but if in correct adjustment the head telephones will be fairly quiet except for the sounds produced by atmospheric disturbances. At wave-lengths above 600 meters increased amplifications are obtained if a suitable coil of inductance is inserted in series with the coil, L-4.

A modification of the foregoing circuits employed at certain commercial and experimental stations is shown in Fig. 2. In this instance the local circuit of the vacuum valve is electrostatically coupled to the secondary winding of the oscillation transformer. The dimensions of the tuning coils may be identical with those given in Fig. 1, but the condenser, C-3, connected in shunt to the head telephones should have a value of .003 microfarad. The apparatus indicated will function on the lower wave-lengths particularly well, giving a fair degree of amplification provided the vacuum valve is set into stable oscillation. The condenser, C-2, is used at very small value of capacity, likewise C-1, depending in the latter case upon the wave-length employed.

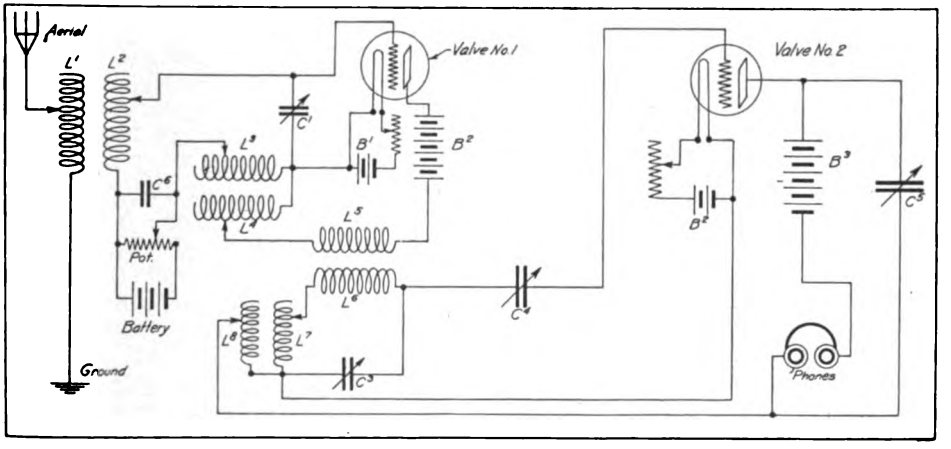


*Fig. 3*

An amplification circuit for currents of radio frequency, somewhat similar to that described in proceedings of the Institute of Radio Engineers, is shown in Fig. 3. Here the currents of radio frequency in the secondary circuit of the first vacuum valve are repeated to the local battery circuit and reinforced by coupling the local circuit back to the secondary circuit. The oscillations of radio frequency thus produced and

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amplified are transferred from the first vacuum valve to the second vacuum valve by means of a radio frequency transformer comprising the coils, L-5 and L-6. The coils, L-6, L-7 and L-8, have the same dimensions as the coils, L-2, L-3 and L-4, in the first system. The condenser, C-3, is identical in capacity with C-1. The condenser, C-4, is operated at exceedingly small values of capacity. The telephone circuit of the second vacuum valve is shunted by the condenser, C-5, in series with which is connected the inductive coil, L-8, inductively coupled to the coil, L-7. The effectiveness of this circuit is increased by the use of the potentiometer and battery connected in shunt to the condenser, C-6. This condenser has a capacity of .003 microfarad. The potentiometer, Pot, may have a resistance of 400 ohms, while the battery, Bat, has available a potential of two or three volts. The secondary circuit of the first vacuum valve and its corresponding local circuit must be adjusted to resonance and also to resonance with the circuit comprising the coils, L-6 and L-7 (Fig. 3). Careful adjustment is then made of the condenser, C-5, and a certain critical value of coupling employed between the coils, L-8 and L-7. Corresponding careful adjustment is made of the high voltage batteries in either circuit with a certain degree of incandescence at the filament. It is preferable in this system that the local circuit of the second vacuum valve be set into undamped oscillation, while the first valve is employed to amplify the current of radio frequency. Circuits of this type have been successfully employed at a wave-length of 600 meters, but they are more stable in operation at longer wave-lengths. The author would be pleased to hear from junior experimenters regarding the results obtained with a circuit of this type operating at the lower range of wave-lengths, in order that effectiveness may be compared with the circuit shown in Figs. 1 and 2.

With a receiving apparatus of the foregoing type properly connected and carefully adjusted, even at wave-lengths of 200 meters, the range of amateur radio stations can be increased considerably and distances heretofore only possible under the most favorable conditions can now be covered without difficulty. In connection with this apparatus it is recommended that receiving telephones of a certain type now in the market be obtained. The receiver in question has a micanite diaphragm, which is connected through a small rod to another diaphragm, the latter being actuated by the electromagnets of the receiver. Laboratory tests show that this telephone has a degree of sensibility from ten to twelve times greater than that of the ordinary type supplied to the amateur field, particularly at the higher range of spark frequency.

An important consideration often overlooked in the experimenters' wireless stations is the need for an aerial switch which will allow of a quick change from transmitting to receiving apparatus. In connection with the vacuum valve detector it is recommended that the aerial switch be constructed so that the high potential battery circuit to the telephones is broken during the period of receiving. The filament should be allowed to burn steadily during the periods of transmission in order that the oscillating state of the vacuum valve may be restored immediately when the high potential battery circuit is closed. Stations fitted with rotary spark gaps requiring a considerable length of time to slow down should fit the rotor with a mechanical or electrical brake to bring it to a quick stop.

The ordinary shunt wound direct current motor can be brought to a quick stop in the following manner: The connection from the armature to the shunt field winding should be brought out to the blades of a double pole switch so that the circuit to the armature may be broken, leaving the shunt field winding connected in shunt to the D.C. line. A sudden interruption of the circuit to the armature will cause the flux of the field coil to place a powerful braking effect on it, bringing it to a very quick stop.

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When the requirements of a first rate radio station are known the problem of intercommunication and overland relay work resolves itself into one of ascertaining the best equipped amateur radio stations in the various states of the United States and finally selecting those which are separated by distances of from thirty to fifty miles. It is recommended that regular watches be observed at these stations by licensed amateur operators capable of copying signals in the continental code at a speed of at least twenty words per minute. If the relay stations are manned by operators possessing the qualifications referred to a large amount of unnecessary interference will be prevented, allowing the messages to be dispatched from point to point without undue delay. The operators in the amateur stations in the immediate vicinity of the relay station also will be saved from the annoyance of unnecessary interference. It is recommended that the greater part of the relay work be carried on at night as the majority of the amateurs cannot remain on watch during the day time.

As the National Amateur Wireless Association continues to expand, the government undoubtedly will allow special wave-lengths for the relaying of messages between licensed amateur stations; for the time being, however, it is advisable to carry on this work with the restricted wave in order that there may be no possibility during the night-time of interference with commercial stations located in the Great Lakes district, or on the Pacific or Atlantic coasts.

Prominent radio organizations can be of considerable assistance to the National Amateur Wireless Association by aiding in the collection of information concerning the apparatus in use, the probable over-all efficiency and the maximum range of certain amateur stations located near them. Such data will be tabulated and filed at the association headquarters for immediate or future reference. At a later period selections will be made from these lists and certain stations will be officially known as an N. A. W. A. relay stations. They will perform the duties which the title involves. Regular hours of watch will be maintained and private communications will be relayed from point to point.

Comments, suggestions for improvement and descriptions of methods for increasing the possible range of amateur stations will gladly be received.

*(To be continued)*

## AMATEUR OPERATORS IN WAR

It is worthy of note in connection with the mobilization of American radio enthusiasts under the auspices of the National Amateur Wireless Association that in Europe amateur operators have been doing their bit and earning well-deserved decorations for distinguished service. The British admiralty alone reports the enlistment of 5,250 wireless operators up to date, and this report takes no account of the wireless men among the land forces. Among the naval men four have received Distinguished Conduct medals, one the Cross of the Legion of Honor, and one the Victoria Cross.

## WORKED A DISTANCE OF 2,614 MILES

Marconi Operator G. L. Brundage, detailed on the steamship Toyohashi Maru, has reported that he recently communicated with San Francisco, Cal., while 2,614 miles away. The vessel is equipped with 120-cycle ½ k.w. Marconi set.

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# A Little Brief Authority

## A Fiction Story

**By Warren H. Miller**

"A PRETTY mess!" snapped the Colonel commanding, angrily. "Here we are expecting the Blue Fleet any night and you say the wireless is down and out. That leaves us with no communication whatever with our own scouts—" he snapped his fingers impatiently and bit his mustachios. This thing galled him: he was the only regular in the manoeuvers and his reputation was, in a way, at stake. "Well, bring in your infernal Dutchman and let's hear your charges, then," he concluded.

Kahler was led in between the provost sergeant and one of his men. They advanced abreast, saluted, and stood at attention. The Colonel confronted them, his adjutant at his right and the accusing lieutenant on the left. To the casual war correspondent it was a funny little group in a sham campaign already full of hilarious mistakes. The Colonel, the only regular present, was bored and angry, the adjutant fussy and excited, the young lieutenant quaking with nervousness, Kahler definant, and the guards awkward and too abashed to remember their parts as set down in the Regulations.

"Proceed with your charges, Mr. Brooks," said the Colonel stiffly to the young lieutenant.

"I went to the wireless station," he began in a shaking voice, "and found Mr. Kahler——"

"There's no such person in the fort," declared the Colonel peremptorily.

"And found Kahler had——"

"When?" interjected the Colonel, cutting him short again.

"This afternoon—as I said, he had the——"

"Kindly prefer your charges in a more formal manner, Mr. Brooks," gritted the Colonel, twirling his mustachios under a concealed smile, "State when, how, and where, if you please."

"This afternoon I went to the wireless station and found Mr.——."

"There is no such——"

"Pardon—found Kahler had the wireless down, so I told him this was no time to be monkeying with it and to get going again at once——"

"Dot's nod so," broke in Kahler, eagerly, "he comes by der vireless——"

"Silence! Hold your tongue, Kahler. Proceed, Mr. Brooks."

"So he starts to give me a song-and-dance about an equalizer or something and I had to start 'em up myself——"

"That will do, Mr. Brooks," broke in the Colonel impatiently, "Did he refuse duty?"

"He did."

"That's sufficient. Now Kahler."

Kahler suppressed a snort and began defiantly. "Vell, these man Brooks, he coom bei my vireless——"

"There's no such person in this fort!" vociferated the Colonel.

"Meester Brooks, den," resumed Kahler with difficulty, "he coom by der vireless ven I vas fixin' up a ekvaliser, *zwischen* der No. 1 und No. 2 mashines——"

"Why?"

"Pecause ve ain't got der power to reach our scouts now, midout two dynamos, efen mit ungedampte wibrations——"

The Colonel nodded his head perplexedly. This was getting in technically deep waters for him. Confound this wireless, anyhow! "Proceed!" he ordered.

"Vell, Yimmy, here——"

"You mean Mr. Brooks?"

"Yaw—Mees'r Brooks, der tufel take



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him!—he vant der bot' mashin's started opp vidout ekvaliser, 'n I tell him dot he doan know 'nuff to run a ten feet steam launch, an' den he order me to start opp der mashin's an' I tell him to go bei der hell——"

"That'll do—that'll do," interrupted the Colonel testily. "Well?"

"Vell, den I go on vit my vork, an' vatch Mr. Vise Guy start 'em opp himself. First he get No. 1 up to voltage an' put her on der bus; den he get oop No. 2 an' look vise for a bit an' den he t'row her in, too, vidout no ekvaliser! Yimminy Crissmus! dere iss a flash an' a crash, an' de bot' maschin's iss on der fritz. Dot's all."

"So you refused duty, did you, Kahler?" inquired the Colonel icily.

"Yaw—der tam fool——"

"Silence! Your actions were a disgrace to the service you represent. Two days in the guard house and two hundred hours' sentry duty. Take him away!" thundered the irate commander. "Mr. Brooks, I'll see you at my headquarters in fifteen minnutes, sir," added the Colonel, dismissing the proceedings.

And the rating that the meddlesome young lieutenant got, in the inner sanctum of the Colonel's private office, while not for public record, will always remain among the worst quarter hours of his whole lifetime.

. . . . . .

"It's one of the curious coincidences of this citizen-soldiery business," remarked the adjutant, talking over the case later. "You see, Kahler is the chief electrical engineer in the Ohio Steel Works, in private life; absolute boss of a large force of engineers, electricians, firemen, thousands of horse power big gas engines, dynamos that would make you and me stand at a respectful distance and view them with awe; in a word, a high-salaried autocrat whose word is law in his own domains, and authority the daily breath he breathes. On the other hand, Brooks happens to be a young and popular clerk in the pay department of this same Ohio Steel, getting about a tenth of Kahler's salary, of about a tenth Kahler's general ability; but he has been in the regiment over four years and has gradually risen by election to his lieutenantship. Kahler came in as a recruit, partly for the relaxation of a two weeks' encampment, partly from a sense of duty in these warlike times. . . . Well, you know Brooks—when he gets on his military mood and shoots out orders in that military voice of his! He may sing very small down at the steel works, but here in the regiment he is authority itself, and it doesn't make any difference who the rookie happens to be either! Now, then, Colonel, the question is who's going to rewind those burnt out dynamos; our scouts might as well not be out there so far as getting us any word from the Blue Fleet is concerned. We are down now to plain eyesight and searchlight, and they may attack in force any night."

"Well, one thing is certain," responded the Colonel truculently, "no mere considerations of temporary expediency shall be allowed to relax one jot of the discipline."

The two days went, anxiously enough, with everyone on the *qui vive* within the fortress, and the slender electrical force working overtime on the wrecked wireless. But while the Blue Fleet did not attack, neither did the bell wire men, lamp hangers and conduit fitters, calling themselves electricians among the enlisted men, make much progress with the dynamos. In an ordinary works the solution of the problem would have been simple—order new dynamos rushed to the scene or hire outside electricians; but where Regulations prevail these things cannot be done—unless you want to pay for it out of your own pocket! Orders in triplicate, on the state commissary and quartermaster, to be approved and explained to everyone in the state up to the Governor himself, must be forwarded if any purchases are to be made or persons hired, and the Colonel much preferred to work out his own salvation.

Kahler was released on the evening of the second night and immediately went on sentry duty. His post was at the far western bastion of the fort with

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*Kahler's eyes stung and smarted from the sharp actinic rays of the blue light, but still he remained at his task*

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the illimitable black sea stretching out from the rocky escarpment, at the foot of the bastion. Somewhere out there was the Blue Fleet, with the tugs and yachts loaned to the militia for "scouts" striving to pick them up and warn the fort by wireless of any intended attack. All of them had feeble, short-distance wireless outfits, capable of picking up a hostile message at long distances and transmitting a message of their own to the fort—some fifty miles. Kahler wondered if the attack would be made that very night; it was a good time for it—pitch black, no moon, inky nor'east clouds, no stars—just a night to rush the fort with a landing party of blue-jackets. That was the way to take it, for the fort was at least equal to the fleet in gun power and range. Even with submarines to help the fort (which it hadn't) a night landing in force stood a good chance of success on such a night as this.

To the west of one section of Kahler's post was a bare rocky hill set with barbed wire and protected from the public by a fence, maybe 300 yards away at the foot of the hill. Just beyond it was the last arc light of the town, standing near the last fire hydrant, at the end of the last street. In times of real war this light would be doused, but in ordinary manoeuvres the city saw no reason to cut its wires. Kahler studied it awhile before returning on his path—and then an idea occurred to him. Three hundred yards! If he could only get away for a time and get under or near that arc light without being yanked up for it! No one had said a word to him about the wireless, but somehow it had seeped in to him at the guard house that it was still down. They had even tried to hook it up to the big searchlight dynamos, a rumor that Kahler had heard with snorts of disdain.

About the third time around he could bear the suspense no longer, and, resting his gun against a bombproof, he vaulted over the parapet, ran down the slope, picked his way through the barbed wire, and soon stood watching under the arc lamp. He waited as long as he dared and then hastily retraced his steps.

"Halt!" cried a voice, "Who goes there!"

"Yaw, dot iss all right—Kahler," rejoined the other, composedly, "'S dot you, Yimmy?"

"Lieutenant Brooks to you, Kahler. What were you doing off post?" inquired Brooks sternly.

Kahler, peering into the darkness, observed that Brooks was carrying the rifle which the former had placed against the bomb-proof.

"What you doin' der Napoleon act vit my gun for? What iss der matter wit' you, Yimmy, anyways?" retorted Kahler.

"I said 'What were you doing off post?' Did you hear me? If so, answer'" gritted Brooks stonily.

"I—I—I heard a noise down yonder. I t'ink he vas a spy, maybe," invented Kahler hastily.

"You did; why didn't you take your gun along and challenge him then?"

Kahler made no reply and Brooks laughed. "Kahler, you'll never make a soldier; you haven't the first idea of it. Well, I won't report you this time, but —he warned—"let me catch you off your beat again, and it will go hard with you!"

"Yaw? Yust you tells dot to der next sentry—he's easy," muttered Kahler whimsically.

"What's that?" inquired the lieutenant harshly.

"Ah—what!" exploded Kahler, turning contemptuously on his heel. The lieutenant fumed. Here was a flagrant breach of discipline—but yet—the Colonel, he had noticed, was getting very tired of these petty cases and was openly hinting so. So he decided not to push the matter further at present and went back along the picket posts.

Kahler turned again to watch the arc lamp. Surely, even at that distance he could discern a slight flicker! With a muttered curse at Brooks and all his like, he vaulted the parapet, raced down the slope, and took the barbed wire in a high hurdle, whipping out a note book and pencil as he neared the arc. And he was just in time. Flickering,

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in long and short wavers, it was spelling out a jagged and half-legible message. Time rushed by, Kahler's eyes stung and smarted from the sharp actinic rays of the blue light, but still he remained at his task, never missing a single one of the faint flickers that would, to the ordinary observer, be almost unnoticeable. Page after page of the dots and dashes grew in his note book; the point of his pencil wore down to an illegible scratch, but still he kept on. And then—a slender hand that shook with anger was placed on his shoulder.

"Consider yourself under arrest!" screamed a high throaty voice in his ear as the thin talons dug into his flesh, "Didn't I tell you on no account to leave your post—and here you are practicing Morse under an arc light, writing a spy message for the enemy, for all I know. Give me that note book and come along with me!"

"Yimmy, you bodder me mooch more, an' I spank you good, yust as I would do if ve were home," retorted Kahler, never taking his eyes off the lamp. "Roon along now an' tell the Colonel I got something for him."

"Hand over that note book, I say," demanded Brooks, drawing his sword and snatching at the book.

"Git oud—*potz tausend,* I knock you——"

"Give me——"

There was a thud of bone on bone, a hard wooden crack, that could be heard a hundred yards, and the lieutenant lay stretched out across the curb. Kahler jotted down the last few dots and dashes, made sure by translation that they were a signature, and fled the scene. What he wanted was light, light to see and translate, and he wanted it quick, with no interference, for the message was of the utmost importance. He ran along the dark parapets of the fort looking for a lighted bomb-proof—any place where he could sit still a few minnutes and see what he was doing. Into the empty barracks kitchen he finally dashed, turned on an incandescent, and busily set to work making a translation of the message. The result of his efforts was twice checked over before he set out for the Colonel's headquarters.

As he neared it there seemed to be a hubbub of excitement within. Orderlies came and went, the provost guard was turning out, hoarse orders were being shouted in the far distances of the fortress. That all this might concern him never entered Kahler's head and, as he pushed open headquarters door, it was with considerable surprise that he found himself gripped by the orderly on duty. The room was filled with excited officers, all of whom were talking at once. Kahler's arrival increased the babel.

It required fully a minute for the Colonel to thunder them into silence. "If you will let Brooks and his indignities rest for a vile and read diss you'll see everything is all right," said Kohler as soon as quiet had been restored. The Colonel looked his disbelief in the statement, but he took the copy of the translation which Kohler thrust into his hand and read it aloud:

"Flagship Alaska, Blue Fleet; disposition for attack on Fort Meade.

"All ships of First Division will assemble, in cutters; landing parties of 300 men each, five cutters in tow of each launch. All ships of Second Division, except colliers and supply ships, will make similar disposition. Third Division of destroyers and torpedo boats will cover landing party. Launches will start at full speed for shore promptly at eleven P. M. No gun will be fired nor any great gun fire permitted until ordered from flagship. First Division will attack west front and Second Division north front of fort. All enemy scout ships in our hands. Coast is clear. R. N. Benton, Rear Admiral, Comm'nd'g."

"Dot means dot we vill have approximately 5,000 men on our hands, Colonel, in less than an hour and der chance of our lives to surprise 'em," lamented Kahler as soon as the Colonel had looked up from the paper.

"Excuse me, Kahler, please forget that you are in the power house of the Ohio Steel Works. Where did you get that message?"

"Off der Blue flagship, of course."

"No; *how* did you come by the message, I mean?"

"I took it off der arc light down bei der

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vest end of der fort. I got it all except the vords 'Rear Admiral' ven I haf to soak Yimmy Brooks, here, for buttin' in."

"*Mister* Brooks, if you please. We'll let that pass for the present. Has any body here any proof that this is nothing more than a clever invention to save this man from further guard house duty?"

"I don't believe a word of it, for one," spoke up Brooks, promptly.

"Nor I—nor I— The man's lying, Colonel—he wrote it up himself to get out of more trouble," broke in the members of the staff.

"Gentlemen, *gentlemen!*" shouted Kahler, raising his voice above the din. "Doesn't anybody here know enough to know dot an arc light iss sensitif to powerful vireless vaves? Any goot electrician could do vat I did—take down Morse off der flicker of der arc—dot's all dere iss to it, Colonel, but you take my atvice you trow on all your searchlights a liddle after eleven an' load all your beeg guns mit shrapnel; also muster every regiment under arms, an do it qvick."

The Colonel brooded a while, looking at Kahler with a frown. "Six days in the guard house. Take him away," said he wearily. "I've got to hand it to you, Kahler, for misplaced inventive genius; you ought to be writing fiction—"

Shots, hoarse hails, shouts and the running of feet by the building interrupted this speech. Scattering volleys blazed from the fort parapets and presently drums and bugles sounded the general alarm and assembly. The Colonel pushed back his chair and sprang to his feet, "It's the attack all right!" exclaimed he. "Gentlemen, to your posts! Kahler, you come along with me!"

They rushed outside in a body. The uproar was tremendous—men and officers running wildly to and fro, whole companies of sleepy militia turning out of their tents and endeavoring to find their arms, while the incessant tattoo of the drums made the night a bedlam of sound. Kahler and the Colonel dashed for the parapets, followed on a run by the aides and umpires who had been hastily sent for at the first alarm. A young lieutenant of the signal corps had already gotten together a squad of men and the cover had been ripped off one of the great searchlights of the main salient. Its powerful rays shot out over the sea on the instant of throwing the switch, disclosing to their eyes long lines of naval cutters as far as the eye could sweep along the sea front.

"One, two three, four, twenty!— there are at least twenty launches, each towing a string of cutters!" exclaimed the adjutant, "and there's a whole squadron of torpedo boats and destroyers behind them. They'll make a landing in less than five minutes if we don't open fire!"

Even as he spoke, bright flashes spit from the fourteen pounders on the destroyers and the nearest umpire threw the searchlight switch, enveloping the whole scene in total darkness. "Sorry, sir," he explained to the Coloned, "but they'v put your searchlights out of business."

The Colonel raged. "And, of course, we have no illuminating rockets!" he swore bitterly. "We must have light! Forsythe, for God's sake hurry up at least a battalion here—they'll be on us before we know it."

He was interrupted by the drumming fire from machine guns on the landing launches, which all opened fire as if at a signal, sweeping the parapet like a hail of bullets. Kahler grabbed the Colonel's arm and dragged him down, but too late. "Sorry, sir," the umpire informed him, "but you are out of action, sir; no living being could have exposed himself to that fire, as you have just done, and survive."

The Colonel cursed impotently. "Here, Kahler," he exclaimed desperately, "take my cap and cloak and run the show. I appoint you aide. Pretend you're back at the steel mill and go to it."

"Can't. You're dead already, Colonel!" interposed the umpire.

"His dying vords," grinned Kahler solemnly, "besides, Mr. Umpire, you have no rules that cover this case. Here!" he called to a great gun squad which was rushing by to their station. "Neffer mind der beeg guns—ve can't use dem now—pull down dot truck shed and build a fire qvick!"

"Who's going to pay for it?" snapped the umpire.

"I vill," said Kahler quietly. "Der

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dam t'ing aind't vorth more dan twenty dollars—an' I vould pay dot mooch ter see der funs."

The Colonel grinned. "What he says goes, boys; rip her down and be quick about it."

Fifty hands tore the shed asunder and soon a flame arose; but while they were at it the machine guns had ceased firing and the rush of the sailors storming up the rocky slopes could plainly be heard above the din within the fort. Battalions rushed to the fire without orders, as the one visible rallying point, and fell into line as quickly as might be. Then a blare of brilliant white rockets arose from the launches as the sailors, in three-high formation, scaled the parapet walls all along the line. Heads by the hundreds and thousands appeared simultaneously over the green revetment, rifles were levelled as the naval men fell forward on their faces, and a tremendous volley of rifle fire was poured into the undisciplined militia.

"Now, den, poys! Gif it to 'em!" shouted Kahler as the militia opened up their return fire, while the umpire ran up on the embankment holding up his signal flag that would give one or the other side the right to advance.

But there was no holding back the bluejackets. That twelve-foot parapet did not stop them a second, and there were thousands below coming on and swarming up over the wall far faster than the militia fire could pick them off. The umpire's flag fell as the tars drove in on the disordered guardsmen; battlion after battalion was checked out of the fight; while from both wings poured in the assaulting columns of the Blue Fleet, driving everything before them. In ten minutes the fight was over and the defenders had surrendered or been put out of action. The surprise attack had been a complete success and not a great gun had been fired from fort or fleet.

The Navy sent up three blue rockets, which were presently answered from the flagship far at sea, and then Captain Nelson, commanding the storming party, came up to commisserate with the Colonel, who was still sitting where the umpire had put him out of action. "Our orders were to board the fort in a seamanlike manner, sir." chuckled the Captain, as the two officers shook hands, and we done it," as Jack Tar would say.

"But what I want to know is," put in the Colonel, "how in the devil did you people pull off that atttack at ten instead of eleven, as ordered?"

"How did you know there was to be any attack at all!" exclaimed the Captain surprisedly, "Our third Division nabbed all your scouts, and the Admiral changed the time to ten by Ardois in case anyone *might* pick up.

"Here's the man that did it," cut in the Colonel, pushing Kahler forward, "read him your message, Kahler—he got it off that arc light yonder."

"Why, hello, Mr. Kahler!" shouted the Captain excitedly. "Say, man, I haven't seen you since I was checking up armor plate down at your works."

The Colonel shrugged his shoulders, "What a country!" he murmured, "Fancy anything like this in undemocratic, militaristic Europe!"

"Oh, Lieutenant McAllister!" the Captain was calling, "Come here, I want you to meet Mr. Kahler of the Ohio Steel——"

"Dere's no such person in der fort!" declared Kahler, grinning quizzically at the Colonel, "I'm yust plain Kahler, under arrest for general monkeydidoes an' a lot of other tam foolishness."

"Got our orders off an arc lamp, you say!" chimed in McAllister, wonderingly, "you must tell us some more about that, Mr. Kahler."

"Vell, poys, it hass been a fine game. But let me tell you, if dis country effer plays it in dead earnest, dere vill be a lot more stranger tricks dan dot played on you military fellers—don't you mistake me!"

"And to learn some of them before they are played will be our only salvation, too, I'm thinking," muttered the Colonel seriously. "Forsythe," he added to his aide, "Battalion's dismissed. Captain, suppose you give your men shore leave for the rest of the night, with our boys to show them around!"

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# "Refund Requested by Return Mail"

## Something About Undelivered Messages

**By Harold H. Gallison**

THE method by which wireless messages are handled from the sender to the addressee is not generally known, whereas the details of other methods of communication are familiar to all. In wireless, as in wire telegraph and the cable, a message now and then will go astray and naturally the sender makes complaint to someone, demanding immediate return of his money. But instantaneous action is, of course, impossible. After an investigation has been made and the telegraph or wireless service is found in any way at fault, a refund of the money paid for the transmission of the message is made. What few can appreciate is that investigations necessarily take time—in some instances two or three months—and rare, indeed, is the complainant who, after a wait of two weeks or less, does not become, at least, irritable. He knows his message did not reach the person to whom it was addressed; why not take his word for it, send him a check at once, and investigate afterwards?

Here is the reason:

To begin with, all radio stations open to public service, both coastal and those on shipboard, are operated under license from the various governments, according to the jurisdiction in which they are located, ship stations being licensed by the governments whose flags they fly. The stations must work in accordance with certain rules and regulations adopted at the International Radiotelegraph Convention, held in London during 1912, and agreed to incidentally by practically every government in the world. This convention was ratified by the United States and a proclamation issued to that effect by President Wilson on July 8, 1913.

The Convention stipulates the method of exchanging traffic between stations and states what rates may be applied to ship and shore stations, the shipboard rate, for instance, not to exceed 40 centimes (8 cents) a word with a ten word minimum.

I do not purpose explaining the various regulations of the London Convention for this would take up much more time and space than I have at my disposal. My object can as well be achieved by showing how the ordinary wireless message is delivered (or fails of delivery as the case may be) from the sender to the addressee.

We will suppose Mr. Williams is returning to New York from Havre on the French liner La Provence. In midocean he files with the wireless operator a ten-word marconigram addressed to "Williams, 1290 Broadway, New York," for which he pays 36 cents per word, receiving from the wireless operator a cash receipt in acknowledgment of the monies received and giving the name of the wireless company receiving it. The first coastal station with which communication is established will be, we will say, Cape Race, the message in due course being received by that station. The Cape Race plant is owned by the Newfoundland Government, be it remembered, and is operated on behalf of that government by the Canadian Marconi Company. The message received, Cape Race in turn transfers it to the Western Union Company for land line transmission and delivery to destination.

Mr. Williams arrives home and learns that his wife did not receive his message, so he looks up the New York address and writes the Marconi Company of America an indignant letter demanding the immediate return of his $3.60. He receives prompt acknowledgment of his letter.

Now for the investigation:



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The wireless apparatus of the office of origin, a French steamer, is owned and operated by the French Marconi Company which has its headquarters in Paris, and if the vessel has left New York on her return voyage before Mr. Williams' complaint has been received, it must be referred to Paris. There is no record of the message in New York and the particular shore station through which transmission was made is not known to the Marconi Company in New York.

The French company, upon referring to its records, learns that the message was forwarded to Cape Race. The complaint is therefore referred to the Canadian Marconi Company in Montreal for further investigation. The Montreal office ascertains that Cape Race correctly received the message and transferred it to the connecting land lines, and the company owning the land lines is now requested to explain why delivery was not made to Mrs. Williams.

Meantime what has become of Mr. Williams' $3.60?

The company operating the station on the La Provence keeps 80c as its proportion and passes on the remainder to the Canadian Marconi Company, which in turn takes $1.70 for its share and that of the Newfoundland Government, remitting the balance, $1.10, to the land line company.

Eventually a report is received from the land line system, stating that the message was delivered to the hall boy of the apartment house at such and such a time, and the hall boy upon being interviewed remembers giving the message to a member of the Williams household, said member still carrying it around with him and having departed for parts unknown.

And there you are! Mr. Williams, not being entitled to refund, loses—and doesn't like it.

Then there are, of course, many instances in which delivery is shown to have been made to the addressee, whose signature on the messenger delivery sheet is held in acknowledgment of proper service performed. In a case of this kind the sender as a rule—having failed to hear from the addressee of his message immediately—jumps to the conclusion that the message was not delivered; whereupon he writes a letter to the Marconi Company demanding the prompt return of his money. And it isn't always easy to convince this fellow that there has been no error anywhere.

A word or two about censorship. At the commencement of the war all telegraph, cable and wireless routes of communication in the belligerent countries were seized by their representative governments and permitted to operate only under very strict censorship regulations. The wireless stations in particular, suffered in this respect. A message filed on board a Dutch steamer and transmitted to the British Post Office station at Crookhaven, we will say, is stopped by the censors. No notice of any such action is sent to the office of origin. In the course of events—since the vessel was bound for this country—a complaint from the sender is received by the Marconi Company in New York. Non-delivery is alleged and a demand is made for refund of his money by return mail, always!

As in the case of Mr. Williams, the complaint is referred abroad. An advice is duly received, stating that "under existing censorship regulations it is regretted that the investigation cannot be continued by the British Post Office." This is the polite method of saying that the message was stopped by the censors and that refund cannot be allowed. Occasionally the reason for which the message was censored is given.

The money paid by the sender has in the regular way been divided up, meanwhile, so much to the ship station and so much to the shore station. The company operating the ship station, holding that the wireless service has been correctly performed in that the message was transmitted to the shore station, will not refund its proportion of the tolls; this company has no proof of non-delivery. The Government administration operating the shore station through which the message was transmitted refuses to investigate—see their letter of such and such a date—and so the matter ends. But not with the sender. He still believes that the Marconi Company in New York has all his money and that no attempt was ever made by anyone to deliver his message.

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**Vessels Recently Equipped With Marconi Apparatus**

| Names | Owners | Call Letters |
|---|---|---|
| Clan Buchanan | Clan Line. | ZBC |
| Clan Maclachlan | Clan Line. | ZBB |
| Armonia | R. Lawrence Smith, Inc. | VES |
| Dochra | Barber & Co. | KGL |
| Uganda | Barber & Co. | ZGA |
| Munamar | Munson Steamship Line | KUI |
| Somerset | Standard Oil Co. of N. J. | KSU |
| Bayway | Standard Oil Co. of N. J. | KSR |
| Motano | Standard Oil Co. of N. J. | KSB |
| Bradford | Standard Oil Co. of N. J. | KNG |
| Iaqua | Union Iron Works Co. | WLI |
| Virginia | Harby Steamship Co. | KFR |
| Tamesi | Freeport and Tampico Fuel Oil Transportation Co. | WTE |

## THE CANADIAN COMPANY'S REPORT

In the annual report and statement of accounts of the Marconi Wireless Telegraph Company of Canada it is declared that during the six months which elapsed before the outbreak of the war, the business of the company continued to make satisfactory progress. The range of the Cape Race station has been greatly increased by the equipment of that important station with steel masts, 250 feet high to replace the 160 foot wooden spars. The establishment of a well-equipped factory in Montreal with excellent shipping facilities has been amply justified.

It is impossible at this time fully to relate the important services the company has rendered to the naval authorities. Calls for assistance have been received almost daily, operators required at short notice for special duty and apparatus for urgent requirements installed practically on demand. The directors of the company have submitted appropriate claims to the naval authorities to compensate for the reduced revenue of the various coast stations.

Practically the whole of the mercantile marine of Canadian and Newfoundland registry has now been equipped with Marconi wireless telegraph apparatus. The Newfoundland Government has enacted legislation providing for the compulsory wireless equipment of all vessels engaged in the seal fishery.

There was a net profit for the year of $50,020, and a surplus of $5,727.

## THE SHARE MARKET

New York, December 22.

There are no developments of special note in the market for Marconi shares. During the month trading has been quiet, with prices moving in a narrow margin.

Bid and asked prices to-day:

American, 3⅜-3⅝; Canadian, 1⅜-1⅝; English, preferred, 8, none offered; English, common, 9, none offered.

## THE MARCONI CHRISTMAS LUNCHEON

The members of the office force of the Marconi Wireless Telegraph Company of America enjoyed a luncheon and entertainment given by the company on the thirty-fifth floor of the Woolworth Building on December 24. The invitations were delivered in the form of a facsimile marconigram. Edward B. Pillsbury, general superintendent of the Trans-Oceanic Division, and Miss T. N. Brown, were in charge of the arrangements for the event. Among those who received the guests were Edward J. Nally, vice-president and general manager of the company; John Bottomley, vice-president, secretary and treasurer, and George De Sousa, traffic manager. After the luncheon a magician entertained with sleight of hand tricks. Dancing followed. About a hundred persons were present.

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# Letter to the National Amateur Wireless Association

## Secretary Daniels' Views Regarding the Organization

**Navy Department**

Washington, Dec. 11, 1915.

Sir:—I beg leave to acknowledge the receipt of a letter from you, a copy of which has just been brought to my attention by the Superintendent of Naval Radio Service.

I am in entire sympathy with the object of the proposed association which plans for the banding together of the thousands of amateur wireless operators in this country so that they may all be actuated by a common desire and impulse to uphold the laws relating to radio communication, to strengthen the hands of the Federal authorities in their endeavors to see that the radio stations of this country shall not be used for unfriendly or unneutral purposes, and further to promote a clear understanding of mutual rights by which radio communication at times of peace may be made effective and reliable by the elimination of unnecessary interference. Further, I can see in such an organization a means by which those young operators can play a considerable part in the large scheme of National Defense. It must be admitted that the reliable and rapid transmission of information constitutes a very important element in National security and defense, and if properly organized with some such object in view, I can conceive of great possibilities from the banding together of the many amateur operators in this country.

As to the acceptance of a post of honorary vice-president in such an organization, I feel that under present circumstances I must decline to accept, following a line of policy which has guided my actions since my advent into public life, and I am sure you can appreciate the reasons which prompt me to take this action.

With this declination, however, I beg to be allowed to suggest some ideas which may redound to the benefit of the government, if the policy of the organization is so shaped as to allow it, and your interest in practical plans for national defense may be enlisted. Some office of the proposed organization will undoubtedly be charged with the duty of recording the names and addresses of such amateurs as join the association. The Naval Radio Service will be particularly anxious to increase its operating personnel in time of public peril, when it would undoubtedly be called upon to man many more shore and ship stations than at present, and it may happen that many of the amateurs would desire to enlist in the naval service at such time for duty, thereby showing their desire to voluntarily serve their country in a way for which they are best fitted. Could I then request that the names and addresses of such amateur operators that may join your association be furnished to the Superintendent of Naval Radio Service who will be charged with the duty of communicating with them to obtain an expression of their desire or willingness to serve their country in time of need, and who will furnish them with information that will make easy the manner of expressing their willingness to thus become a factor in the large scheme of national defense?

Very truly yours,

(Signed) JOSEPHUS DANIELS.



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# From and For those who help themselves

## Experimenters' Experiences.

*The editor of this department will give preferential attention to contributions containing full constructional details, in addition to drawings.*

### FIRST PRIZE, TEN DOLLARS

### A Suggested Design for a Wireless Piano

The interest of the amateur field was keenly aroused a little more than two years ago by the published accounts of the wireless piano installed on the Prince of Monaco's yacht, the Hirondelle. After examining the diagrams which were published the average experimenter concluded that apparatus of this type was too expensive and too complicated in construction for his use. However, a study of the conditions to be fulfilled in a system of this type will enable the amateur to gain a clear idea of the apparatus I recently designed.

In Fig. 1 a simplified circuit of the Von Lepel system on the Hirondelle is given, wherein an arc gap composed of revolving copper discs is connected to a source of 1,500 volts direct current through two choke coils. The usual inductance and capacity are shunted around the arc and the frequency of oscillation is determined by the constants of the closed oscillatory circuit. In addition, the arc gap is shunted by an inductance coil and eight condensers of different capacity, each of the latter being connected to a telegraph key or circuit closer. When the arc is in normal operation undamped oscillations flow through the closed oscillatory circuit, but if either of the condenser keys indicated in Fig. 1 is closed the energy of the closed oscillatory circuit is diverted to the latter circuit which discharges at an audible frequency across the arc.

Thus the energy of the antenna system is altered in accordance with the discharges of audible frequency through the arc gap and consequently a musical note having a characteristic dependent upon the inductance of the coil, L, and capacity of the key condenser in use is produced. In this manner, pure, musical tones which are highly pleasing to the ear are obtained. By proper selection of capacities the scale of an octave can be reproduced and single note music sent through space to other radio stations. The method just described is somewhat similar to that of the singing or musical arc the circuit for which is shown to the right of Fig. 1. In this instance condensers of large capacity are shunted across the arc gap and if the proper values are employed the arc will emit pure, musical notes.

Knowing that apparatus of the Von Lepel type is beyond the reach of the experimenter I designed a small wireless piano set which I believe will be a source of considerable amusement to the junior experimenter. The apparatus completely assembled is shown in Fig. 2 where it will be observed that a keyboard with eight circuit closing keys, a special high frequency interruptor, a storage cell, spark coil and an aerial tuning inductance are conveniently mounted for operation. In this apparatus variable tones are obtained from the spark coil by means of a specially constructed interruptor, a side view of which is shown in Fig. 3



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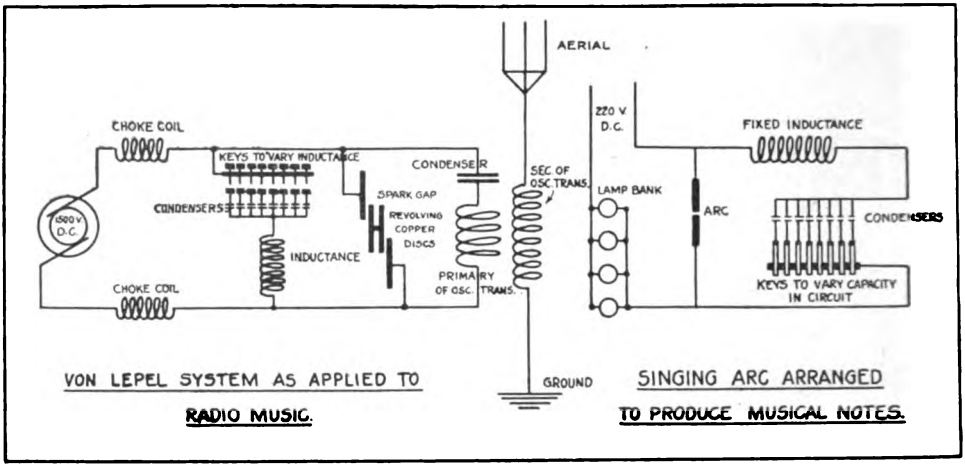


*Fig. 1, First Prize Article*

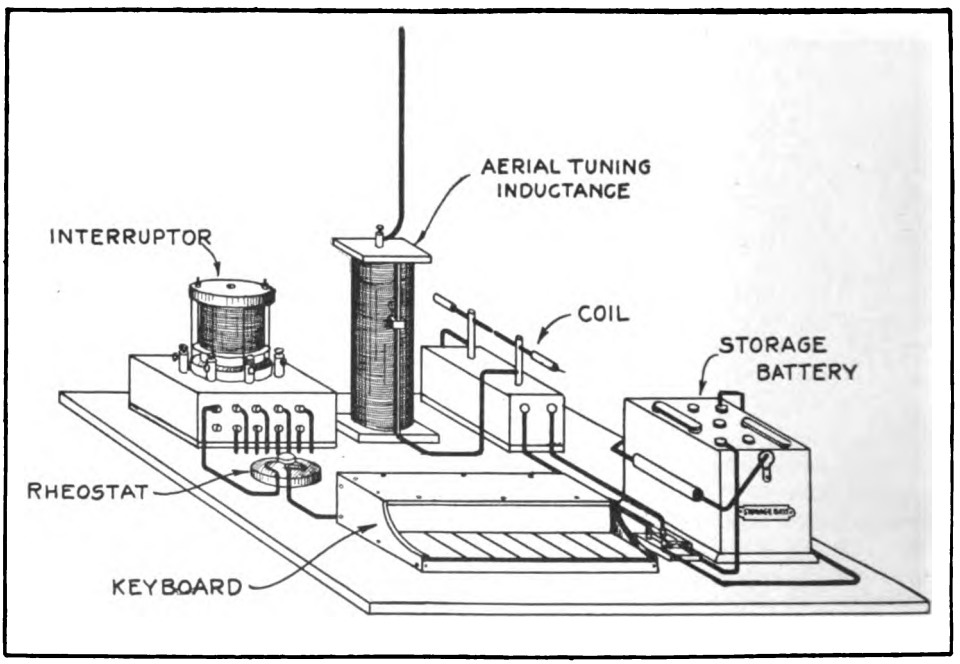


*Fig. 2, First Prize Article*

and a top view in Fig. 4. The apparatus consists essentially of a vertical electro magnet surrounded by eight vertical steel wires upon which are mounted contact points through which the circuit to the primary winding is completed. When the storage battery is connected to the circuit, interruptions take place at either of the wires at a certain frequency, depending upon the tension. By careful adjustment the tone of all wires can be altered so that the notes of an octave are faithfully reproduced.

The complete interruptor comprises a shallow box 6½ inches square outside and 1½ inches in depth. A top of hard rubber, ¼ of an inch in thickness, has a 4-inch hole cut in its center. On a circumference ¼ of an inch from

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the edge of the hole, eight holes are drilled to pass 8/32 screws. These are, of course, equally spaced around the circle. In these are mounted eight binding posts, 1 inch in height, which

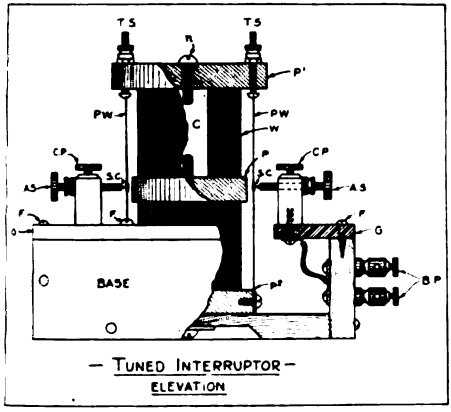


*Fig. 3, First Prize Article*

take the piece, AS, having the platinum contact point, SC. Each of the posts are connected to separate binding posts mounted on one side of the box.

The core for the winding of the magnet is made of two soft iron rods, ¾ of an inch in diameter, each of which is 1¾ inches in length. The head or

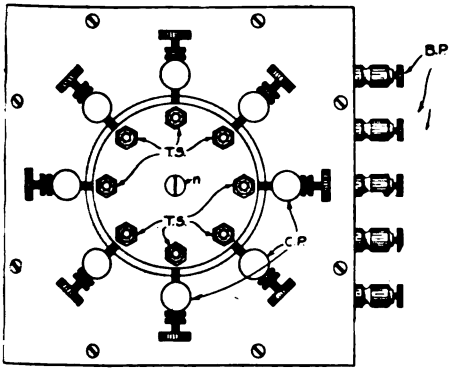


*Fig. 4, First Prize Article*

the top, P', is of soft iron, ½ of an inch in thickness and 3 inches outside diameter. Eight holes are bored ¼ of an inch from the edge, large enough to pass 8/32 machine screws. In addition a hole is bored in the center for a 10/32 screw to take the bolt, N.

The pole piece, P, is also of soft iron ½ of an inch in thickness and 2¼ inches in diameter. This has a hole bored and threaded for a 10/32 screw. Be sure to place the holes exactly in the center of these pieces in order to show a good fit throughout. It is a good plan to bore the holes before turning up the piece on a lathe. In this manner the builder is assured that all parts will be true. The bottom pole piece, P-2, of soft iron, is ½ of an inch in thickness and 2½ inches in diameter. Eight holes for 8/32 screws are bored around its circumference, as indicated.

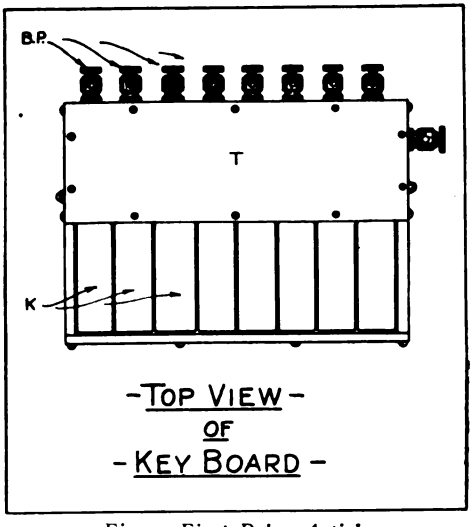


*Fig. 5, First Prize Article*

The cores are then wound with No. 16 D.C. copper wire, in opposite directions, so that the center piece will be of one polarity while the ends will be of opposite polarity. One terminal of the winding is fastened to a binding post and the other terminal is soldered to the core.

As mentioned previously, the vibrating member consists of eight 6-inch lengths of piano wire. One end of the wire is soldered to a 1¼-inch brass screw, 8/32 thread; about 1¾ inches from this screw a piece of fine silver wire is tightly wrapped around the steel wire to form a contact. This should be at least ⅛ of an inch in length so as to allow for a slight movement of the contact up or down while the tautness of the wire is being ad-

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justed. The silver should be so attached to the set screws that the contact points will come opposite the pole piece, P. It is vital that the screws in the top of bottom pole pieces be exactly in line; otherwise the wires will be thrown out of the proper position for making contact. The wires being in position, fasten the coil in the exact

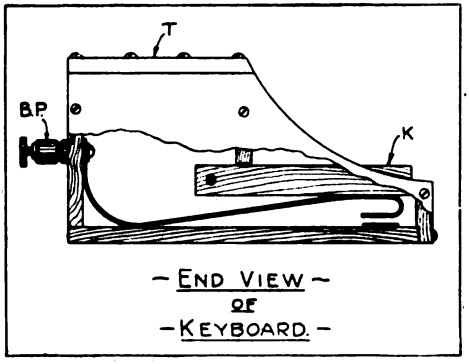


*Fig. 6, First Prize Article*

center of the box and make everything secure. The interrupter is now ready for adjustment, but before trying it out it is advisable to construct the accompanying keyboard, the parts of which are indicated in Figs. 5 and 6. Of course the dimensions indicated may be altered if desired, but those given should be duplicated if possible. The keyboard is 6 inches in width by 9 inches in length over-all. The back is 3 inches in height and the top 3 inches in width, while the front has a height of 1 inch. The keys are 3½ inches in length, 1 inch wide and ½ of an inch in thickness. A hole is bored through each key ¼ of an inch from the back end to fit a ⅛-inch brass rod. This rod is supported by holes through the end of the box, 1 inch in height from the bottom and 3⅝ inches from the front edge. The ends of the rod are threaded and the nuts placed. The keys are strung on this rod with a 1/16-inch washer between them. The back stop is just 1½ inches in width and when the key is up it will be parallel to the base.

A strip of 1/16-inch brass, ½ of an inch in width, is fastened to the bottom of the box (which, by the way, should be of ¾-inch stock throughout) ¼ of an inch from the front inside edge. This is connected to the binding post mounted on one end of the box. The springs shown consist of strips of 1/16-inch brass, ½ of an inch in width and 7 inches long. These are bent to the form shown and one end of each is clamped under the screw of a binding post, while the other end should be placed just over the brass strip. The keyboard is now finished, but a condenser may be mounted under the top of the box and connected to the circuit, as shown in the diagram of connections (Fig. 7). This condenser is not absolutely necessary as the one usually mounted in the base of an induction coil may be employed instead.

The keyboard should now be wired to the interruptor and careful adjustment made of all the vibrating strings. The tautness of the wires should be carefully adjusted until the notes produced by the spark gap imitate the successive tones of an octave. This may be found a tedious operation but will well repay the labor involved.

It will be observed that the spark gap of the induction coil is connected in series with the antenna system but if desired an

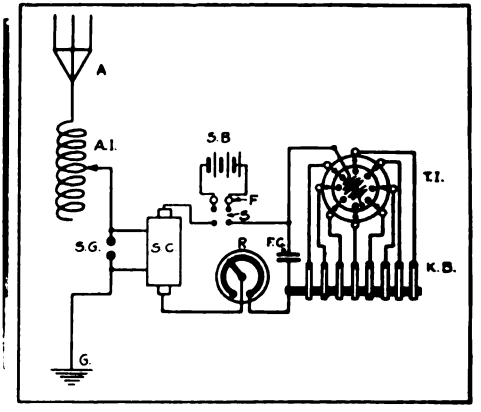


*Fig. 7, First Prize Article*

oscillation transformer may be employed in the regular manner.

My advice to the amateur experimenter is that he keep neighboring amateurs ignorant of the fact that a device of this kind is under construction. After a little preliminary adjustment and practice he may proceed to call all those within range and en-

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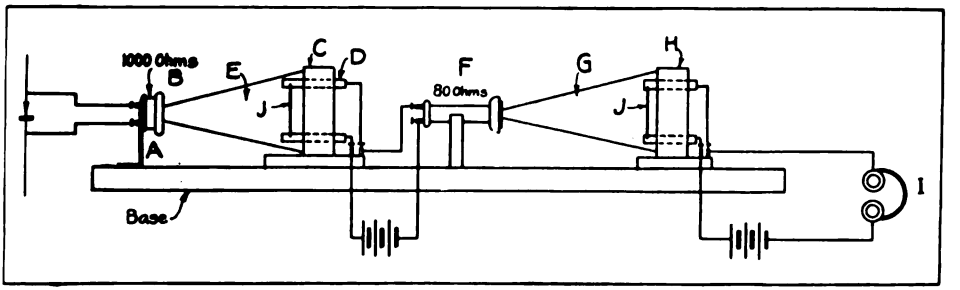


*Fig. 1, Second Prize Article*

tertain them with simple musical "skits." He should then be prepared for an onslaught of queries, for the entire neighborhood is bound to be curious concerning the origin of this mysterious music and the manner in which it is produced.

THOMAS W. BENSON, *Pennsylvania.*

## SECOND PRIZE, FIVE DOLLARS

### An Amplifier Used with Home-Made Receiving Apparatus

The amplifying apparatus about to be described has been used for the last six months with extremely satisfactory results. In conjunction with home-made receiving apparatus comprising an inductively-coupled receiving tuner, fixed condenser, galena detector and a pair of Murdock 2,000-ohm head telephones, connected to an aerial 125 feet in length by 50 feet in height at both ends, I am enabled to copy Arlington, Sayville, Duluth, and Key West with the head telephones at a distance of five feet from the ears. I also hear Atlantic coast stations at a distance of at least four feet from the receivers.

As indicated in Fig. 1, a 1,000-ohm wireless receiver is mounted on a brass upright so that the center of the hole in the diaphragm will be three inches above the base. C is a side view of the microphone while the front view is indicated in Fig. 2. The base of the microphone is 3 inches by 6 inches by ½ of an inch. The upright is mounted in the center of the base, having the dimensions given in Fig. 2. D and D¹ are ½-inch electric light carbons, 3 inches in length. J is a ¼-inch flash light battery carbon, 3 inches in length, both ends of which are filed to a point. A small hole is bored in D and D¹ that the carbon can just fit in and be a little free to move. A wire is taken from D and D¹ and connected to an 80-ohm telephone receiver with two or three old dry cells connected in series.

A pasteboard megaphone constructed to make a tight fit over the 5½-inch disc, having a thickness of ⅜ of an inch is shown in Fig. 2. The small end is glued over the hole in the telephone receivers. The second microphone is of similar construction to the first and the megaphone extends from it to the 80-ohm receiver. Two old, dry cells are connected in series with the second microphone and when all the foregoing connections have been made the amplifier is ready for operation. After the microphone has been in use for about one month a slight diminution in the strength of signals may be noticed. This can easily be remedied by spinning the movable carbon in each microphone.

FRANCIS J. BRENNAN, *Pennsylvania.*

## THIRD PRIZE, THREE DOLLARS

### An Aerial Mast of Substantial Design Which Costs Little

Many an amateur ambitious to increase the range of his station recognizes the need of a well elevated aerial, but he finds it difficult to find a mast of considerable height at a small expense. Confronted with a similar problem, I solved it in the following manner: A complete diagram for a mast I erected is given in the accompanying drawing. The drawing is largely self-explanatory and gives all

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the necessary dimensions. It will be noted that the mast consists of three sections of iron pipe which slide into each other and are prevented from telescoping by a ⅜-inch rod iron bolts passing entirely through the pipe. Reducing couplings are worthless for joining the sections as they snap while the pole is being raised. Bolts 1 and 2

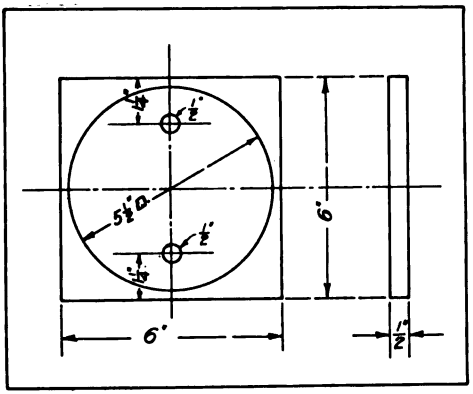



*Fig. 2, Second Prize Article*

must be at right angles to the strain exerted by the aerial so that the sections can swing slightly on them as an axis, thus reducing the strain.

The three guy wires are galvanized stranded iron wire looped around the pole. These are prevented from slipping down by the bolt No. 2 which projects several inches from both sides of the pipe.

It is advisable to use turn buckles on the guy wires. The open end of the top section should be plugged to keep the inside of the pole from rusting and the outside of the mast should be given a good coat of white lead paint.

The mast may be raised by any of the methods commonly employed. As the center of gravity is low, the operation is not extremely difficult. Excellent anchors for the guy wires may be made by burying two short pieces of pipe crossed like a plus sign about 3½ feet in the ground with plenty of rock ballast on top.

The advantages of this type of mast are strength, small surface exposed to the wind, permanence and good appearance.

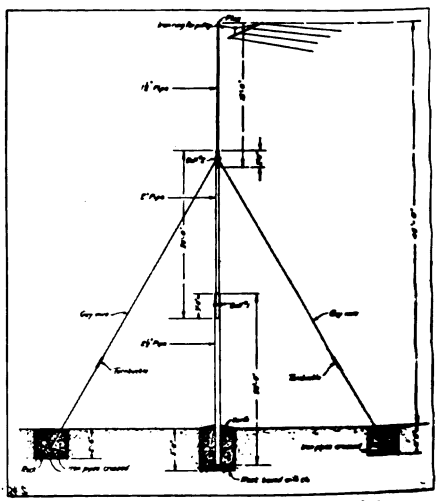
S. B. YOUNG, *Massachusetts.*

## FOURTH PRIZE, SUBSCRIPTION TO THE WIRELESS AGE

### A Receiving Detector Which Gives No Trouble in Adjustment

The receiving detector about to be described has been in use at my station for a period of four months and during this time has given no trouble whatsoever in adjustment. After a series of experiments with various crystals I have decided that for all around amateur work the "Perikon" detector is to be preferred, but I also find it difficult to maintain it in a sensitive state of adjustment. I therefore investigated various types of construction until I hit upon the following design which, I believe, will interest the amateur field.

The complete detector is covered in Fig. 1 and is constructed in the following manner: The cup which holds the crystal is made from a brass fuse cap about ½ of an inch in diameter. This



*Drawing, Third Prize Article*

cup is filled almost to the edge with soft metal in which is placed a piece of good, sensitive zincite. While the soft metal is still warm rub a piece of ordinary paraffine over it, leaving the metal covered with a thin insulating layer of wax. This completed, push the cup into the end of a fibre tube ½ of an inch inside diameter, taking care not to remove or loosen the paraffine coating. Leave the end of the brass cup flush with the end of the fibre

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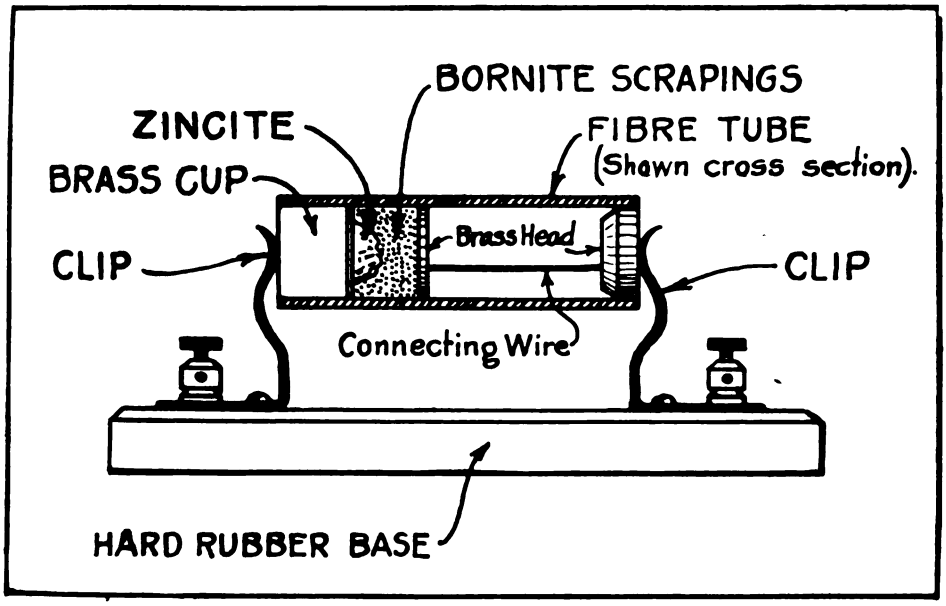


*Drawing, Fourth Prize Article*

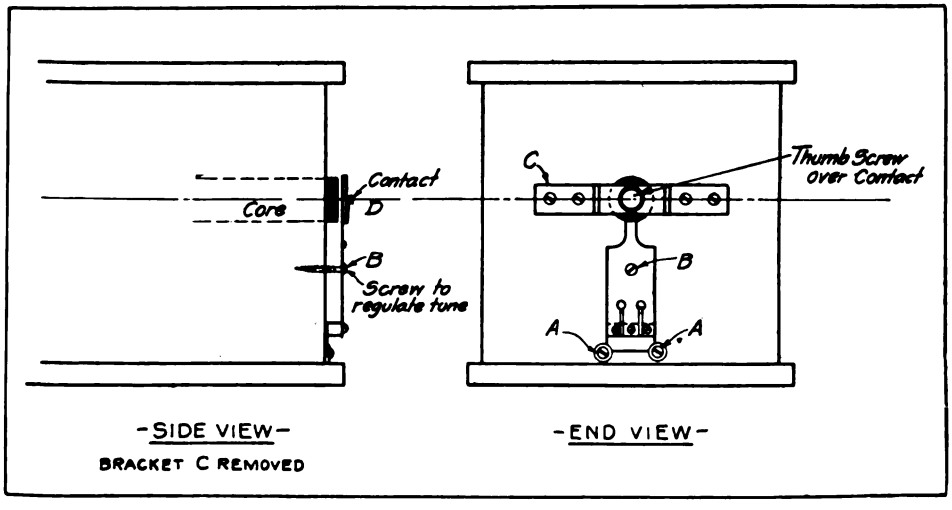


*Fig. 1, Honorary Mention Article, G. K. Barnes*

tube. Next take a piece of bornite and scrape off a quantity of filings. Pour these filings into the tube until the zincite is covered. Next place a brass disc in the tube to hold the filings in place. Take a piece of brass ½ of an inch in diameter and work it into the end of the tube, connecting it to the other brass disc by a piece of wire. The detector is now ready for use.

A detector base may be made, as indicated in Fig. 1. The holder consists of two brass clips mounted on a hard rubber base, each clip in turn being connected to a binding post. The detector may then be placed between the two clips and, of course, quickly removed whenever necessary.

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If desired, a crystal of silicon, galena or carborundum may be substituted for the zincite and brass filings for the bornite scrapings. Suitable soft metal for mounting the crystals can be made by mixing an ounce of mercury with tin-foil until it forms a very stiff mass.

I trust that other amateurs will be able to obtain results similar to those I have obtained.

OLIVER M. BLACK, *Massachusetts.*

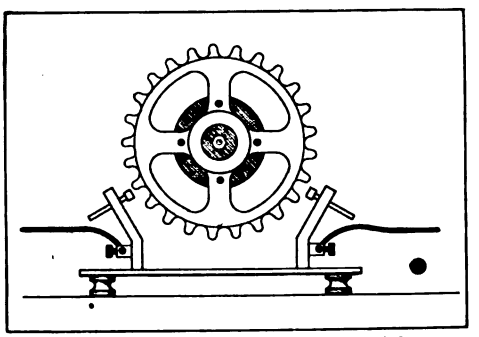

*Fig. 1, Honorary Mention Article, Samuel W. Place*

## HONORARY MENTION

Having experienced considerable trouble with the vibrator on my spark coil, I improved its action and the resulting note. The vibrator spring shown in the accompanying drawing is a part of the J. B. master vibrator, fastened by means of washers at A. The armature shown should be about ⅛ of an inch from the end of the core before the screw, B, is put in place.

If the screw, B, is attached to the vibrator, as shown, and careful regulation of it is made, an extremely pleasing note is produced which, I believe, will satisfy many amateurs who have had my experience.

G. K. BARNES, *Connecticut.*

## HONORARY MENTION

An efficient rotary spark gap can be constructed at small expense in the following manner:

The sprocket wheel of an old bicycle is employed as the rotor, while the stationary electrodes are of zinc mounted on a piece of ⅜ of an inch square brass motor an extremely high pitched spark rod, bent as shown in the accompanying drawing. I have found that a sprocket wheel 8 inches in diameter with 25 teeth works admirably. It is mounted on the shaft of a small A. C. or D. C. motor as follows:

Turn out a disc on a lathe about 4 inches in diameter and ½ inch in thickness. Drill a hole at the center of the disc large enough to take a bushing to fit on the motor shaft. Slide the disc on the bushing and clamp it tight; then fasten the bushing to the shaft with a set screw. The disc, of course, is preferably of hard rubber, bakelite or fibre.

The sprocket wheel has a hole in the center, about an inch and a quarter in diameter, and it would be well when turning out the disc to make a projection or shoulder at the center of the disc of the same diameter as the sprocket wheel. In this manner the sprocket wheel can be fitted over the

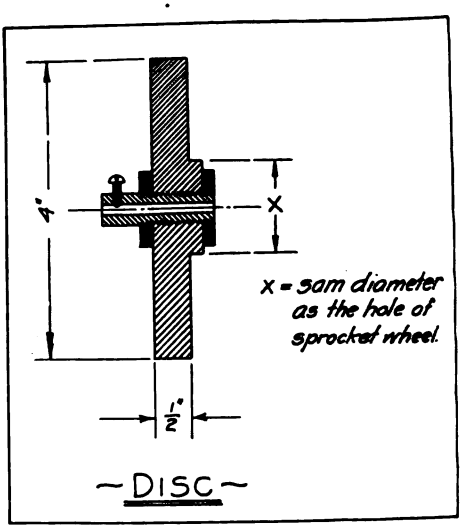


*Fig. 2, Honorary Mention Article, Samuel W. Place*

projection, eliminating the necesssity of trueing up the wheel. Several holes are drilled in the sprocket wheel, which is then fastened to the disc by means of machine screws. Two electrodes may then be placed on either side of the wheel and connections from the closed oscillatory circuit made to them. I find that by using a very high speed note is produced which, as all amateurs know, is desirable.

If the motor revolves at a speed of 4,000 R.P.M , there will be 1,600 sparks per second, the equivalent of an 800-

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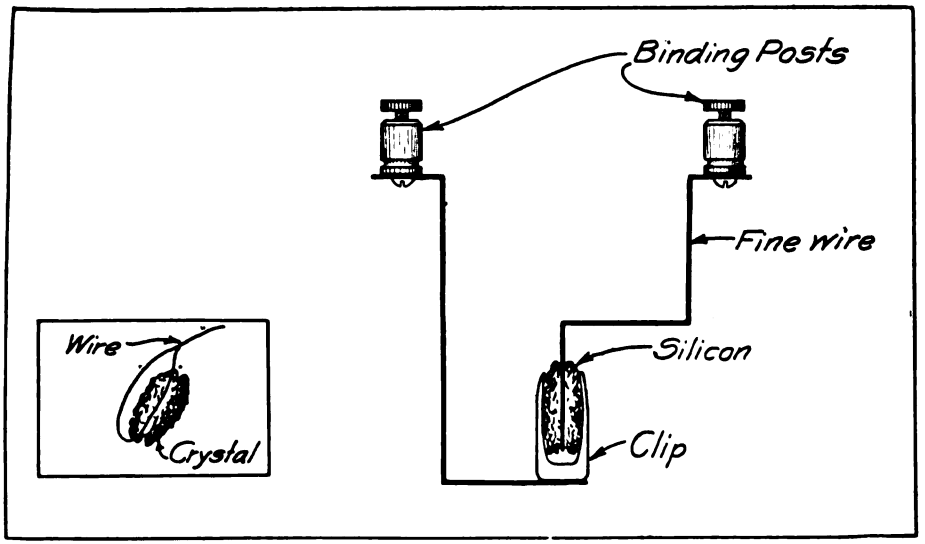


*Drawing, Honorary Mention Article, Vern F. Santar*

cycle spark. Unless the motor is rather powerful, it is doubtful whether this speed can be obtained, but in my own experiments I have found that a 1-30th h.p. A. C. motor will drive the sprocket wheel at a speed of from 2,000 to 2,500 R.P.M., the equivalent of a 400 or 500-cycle spark.

At this frequency it is advisable to decrease the capacity of the condenser, because, owing to the rapid rate of interruptions at the gap, the condenser formerly employed with this set cannot be fully charged and discharged.

SAMUEL W. PLACE, *Pennsylvania.*

## HONORARY MENTION

I have tried a great many types of crystalline detectors, but the majority of them will not remain in adjustment for any length of time.

I therefore evolved a method for making the adjustment of a silicon detector permanent. The procedure is as follows: First, secure a piece of sensitive silicon and cut two notches on opposite sides of the crystal. Then wrap a piece of fine wire in the notches and extend the wire to the binding post, as in Fig. 1. Next secure a good clip and set the crystal in it, taking care to allow the wire and the clip to come in contact. Then light a candle and let the melted paraffine drop on the crystal until it is completely covered at the point where the wire is wound. Take connections from the clip and from the winding to binding post. The complete crystal should then be enclosed in a small box.

I have used a detector of this type for some time and it positively does not jar out of adjustment.

VERN F. SANTAR, *Florida.*

## HONORARY MENTION

As a general thing the amateur wireless operator who must depend upon a vibrator for the production of high potential current has many troubles to bear. In order to obtain a heavy spark at the secondary winding, vibrators are stiffened by pieces of paper, etc., fitted back of the vibrator spring. A coil when so adjusted gives an "overload" spark. I found by experiment that the sluggishness in vibrators is not always due to the design of the vibrator nor the spring itself, but may be accounted for by the fact that the button of soft iron at the end of the spring is more or less hard and therefore to some extent magnetized.

I experienced difficulty with an interrupter of this type and found later by experiment that this button possessed sufficient residual magnetism to pick up small tacks, etc., I removed it from the end of the spring and heated it slowly to a red heat, allowing it to cool in a similar manner. After it had been so treated, the action of the vibrator was considerably improved and the secondary spark much clearer.

L. BARRIETTE, *New York.*

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# A Station in the Far North

## The Marconi Link at Ketchikan, Alaska. Its Equipment and Points of Interest

**By A. A. Isbell**

LOCATED in Alaska—a region where a glamour born of the wilds prevails to a certain degree, the Ketchikan station of the Marconi Wireless Telegraph Company of America equals in interest any of the links in the company's system. The majority of persons are attracted first by the aerial-carrying structures of the station. The towers at Ketchikan are four in number, each 300 feet high to the head of the steel. Stepped on top of each tower is a wooden topmast projecting fourteen feet, on top of which are mounted 80,000-volt, triple-petticoat porcelain insulators carrying the receiving aerial, which is also used as a transmitting aerial for the 5-kw., marine station. The towers stand at the four corners of a rectangle, 300 feet by 600 feet, the long axis of which points directly towards Astoria, Oregon. A twenty-wire antenna is supported on two triatic stays between the towers, and all twenty wires are carried to the steel power-house, located approximately 300 feet from the first two towers and exactly on an extension of the long axis of the rectangle mentioned.

The ground system consists of some 3,000 pounds of zinc plates buried in a circle about the steel power house, with three strips four feet wide, running out on the beach to mean low tide levels. One of the three strips runs for 100 feet in the bed of a small creek before reaching the beach. Owing to the excessive rainfall the ground plates are always wet.

Power at 2,300 volts and a frequency of sixty is obtained from Ketchikan, about two miles away,. At a point 300 feet from the power-house the current enters an underground conduit and is taken to the high-tension switchboard; from there it is distributed to the heating, lighting, and power transformers, according to standard methods.

In the power-house, constructed of steel and concrete, are located the high and low tension switchboards; a rotary converter for furnishing direct current for operating solenoid keys; side disc motors, remote control oil switches, all power transformers, a 25-k.w. condenser bank of thirty tanks, an oscillation transformer for a 25-k.w. plant, and a solenoid key operated from the office seventy-five feet distant. The rotary converter referred to also drives the 25-k.w. disc.

The 25-k.w. station has transmitted to San Francisco in daylight and can be copied on a typewriter at Bremerton Navy Yard, Puget Sound, Washington, and at Juneau, Alaska; Cordova, Alaska, reports that very strong signals have been received from Ketchikan.

The wooden office building contains the 5-k.w., sixty-cycle Marconi plant for communicating with ships. It has worked with the following stations at midday: Unalga, near Dutch Harbor, Alaska; Kodiak, Alaska; Cordova, Alaska; Sitka, Alaska; Tatoosh Island, off Cape Flattery, Washington; North Head, Washington, and Table Bluff, California. The first and the last on the foregoing list are approximately 1,200 miles away from Ketchikan. All of the Canadian stations on the Pacific coast can be communicated with in daylight. The 5-k.w. station is equipped with a non-synchronous gap, working normally at 240 sparks a second. Its regular wave-length is 1,700 meters, but at times it works on 3,000 meters, and, of course, complies with the law with reference to three hundred and six hundred meters.

In addition to the ship station the office building contains all controls for the 25-k.w. station. Without moving his chair, the operator can start and operate either the 5-k.w., or the 25-k.w. station. There are two tuners, one having a range



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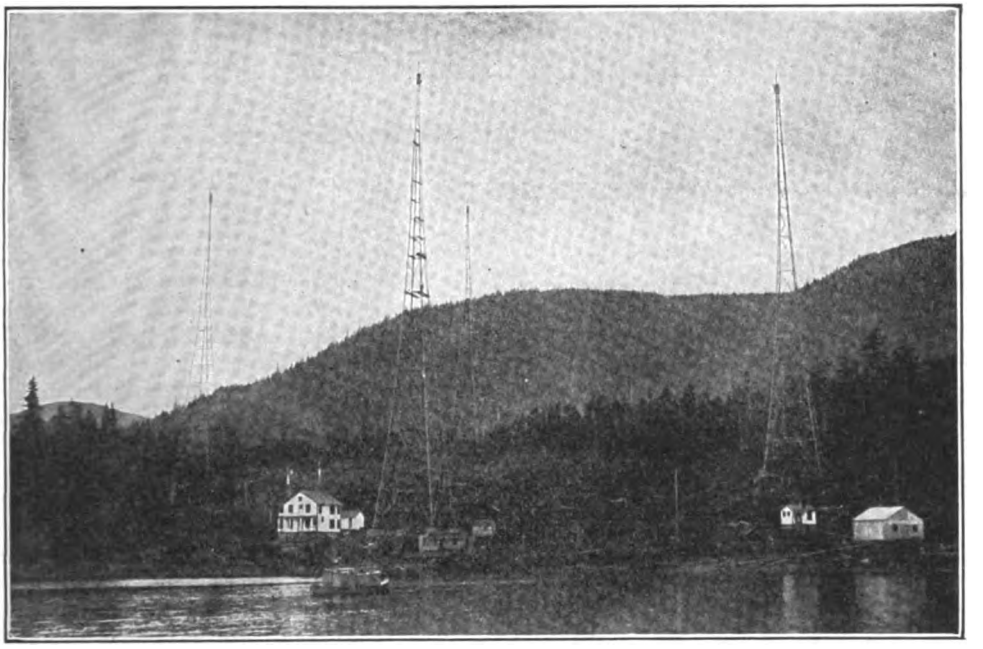

*This photograph shows the picturesque location of the Ketchikan station. Its four towers are generally the first features of the plant to catch the visitor's eye*

of from 100 to 4,000 meters and the other from 100 to 7,000 meters. On the latter the Marconi Honolulu station can be copied at any time during daylight. Bolinas can be copied on either tuner with a typewriter.

The main hot wire ammeter of the 25-k.w. plant cannot be seen while an operator is transmitting at the office. Therefore, the writer devised a method for operating a small auxiliary hot wire ammeter which is located in the office in view of the operator. This shows when anything is wrong with the 25-kw. apparatus.

The two-flat dwelling, which has been well furnished by the Marconi Company, contains all modern conveniences. Water is supplied from a reservoir having approximately 12,000 gallons' capacity. It is located on high ground back of the first right-hand tower. All of the buildings at the plant are connected by substantial board walks. A board walk leading from the plant to Ketchikan provides a thoroughfare for pedestrians.

## NEW RECEIVING STATION IN MAINE

A new wireless receiving station has been erected at Deering, a suburb of Portland, Maine, and will be operated as a branch of the station at Tuckerton. One of the men connected with the management of the Tuckerton station said that the decision to build the receiving station in Maine was reached after a series of experiments carried on in co-operation with United States naval officers, and they were in favor, from a scientific standpoint, of placing the receiving station farther north. The Tuckerton station has been operated for a considerable time under the supervision and control of the United States Naval Radio Service. The Deering station will also be operated under the control of the Radio Service.

## WIRELESS TO ARGENTINA

The Argentine Government, it was announced recently in a newspaper, has granted a concession for the erection of a high-power wireless station at Buenos Aires, plans having been completed for establishing a radio service between the United States and the South American republic. A station will also be built near New York City.

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# Marconi Decremeter No. 24

**(Special Instructions to Marconi Inspectors)**

**PART II (Conclusion)**

FOR convenience in making calculations of a wireless telegraph circuit, a table is attached (Fig. 10), giving certain corresponding values for wave-lengths from 100 to 5,000 meters, viz.: the wave-length, the wave-length squared, the corresponding frequency, oscillation constant (square root of the inductance times the capacity), oscillation constant squared, product of the inductance by the capacity, and the difference in one meter wave-length at all wave-lengths as noted.

For example: Should the wave-length of an oscillatory circuit be measured and found to be 200 meters and if the capacity value of that circuit is definitely known, the value of inductance may be determined by dividing the value, L × K, corresponding to 200 meters, by K, the known capacity.

The constants of an oscillatory circuit are related as follows, the symbols used being the same as given in the table:

$$\lambda = 59.6\sqrt{LK} \qquad (1)$$

$$N = \frac{5.033 \times 10^6}{\sqrt{LK}} \qquad (2)$$

$$\lambda = \frac{3 \times 10^8}{N} \qquad (3)$$

It will thus be seen that $\lambda$ is proportional to the $\sqrt{LK}$ and accordingly $\lambda^2$ proportional to LK; furthermore, N, the frequency, is inversely proportional to the oscillation constant or the $\sqrt{LK}$. By careful consideration of the fundamental relations numerous calculations may be quickly performed.

The wave-length of an oscillatory circuit of the type encountered in receiving sets may be determined as per Fig. 4. The circuit of unknown wave-length, LK, is set into excitation by the buzzer and battery.

The complete decremeter circuits are indicated to the right of the drawing. Owing to the feebleness of the oscillations emitted by the buzzer excitation system, a sensitive crystal detector is switched into the decremeter circuit. For preliminary trials, the coil, L, of the decremeter is placed in close inductive relation to L′ and adjustments made at the variable condenser, K, also at the crystal detector, D, until a resonant response is secured.

For some accurate determination L is moved at a distance from L′ until the signals are just audible.

When taking such observations it is important that the buzzer contacts be free from all sparking, as otherwise the constants of the wave-meter circuit are seriously altered.

The wave-length of the closed oscillatory circuit of a wireless telegraph transmitter is obtained as per Fig. 5. Here the inductance coil, L, of the wave-meter is placed in inductive relation to L′, the primary winding of the oscillation transformer. The galvanometer of the decremeter is connected in the circuit.

The capacity of the wave-meter, condenser, K, is altered until a maximum deflection is secured in the galvanometer; the two circuits are then in electrical resonance and the wave-length is read directly from the condenser scale.

Care should be taken that the coil, L, is at a sufficient distance from L′ to prevent the galvanometer from burning out.

### Determination of the Wave-Length of an Aerial System

The fundamental wave-length of a complete aerial system is obtained as per Fig. 6. The spark gap, S, in series with the antenna is connected to the secondary winding of a high potential transformer or induction coil. The inductance coil, L, of the wave-meter is placed in inductive relation to the earth lead of the aerial system. The capacity of the condenser, K, is altered until the maximum



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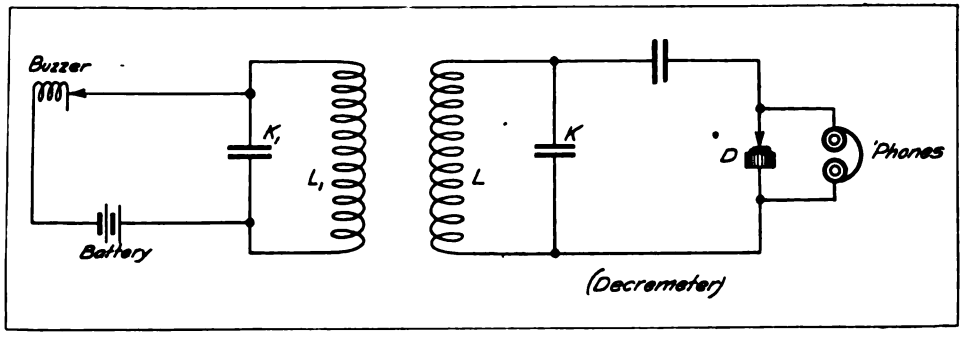


*Fig. 4*

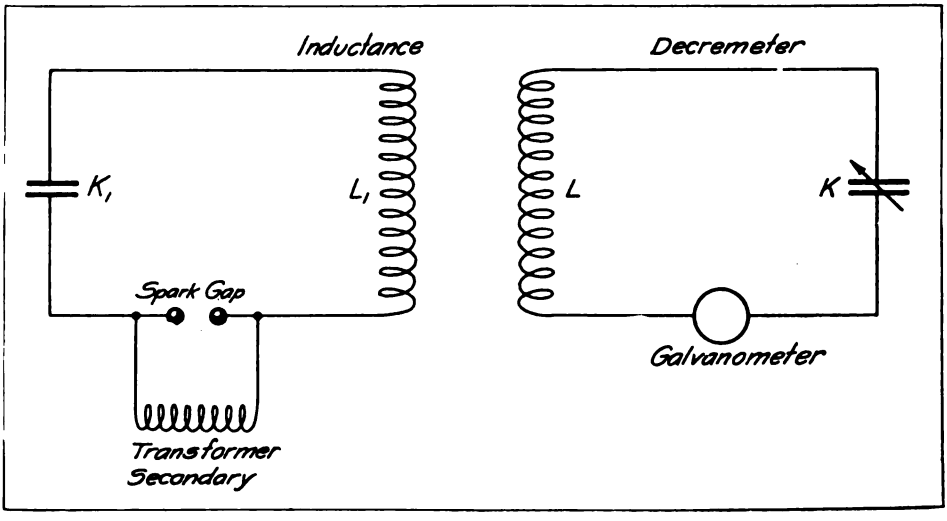


*Fig. 5*

deflection is secured in the galvanometer, indicating resonance between the aerial circuits and the wave-meter. If desired, the galvanometer may be disconnected from the circuit and the conditions of resonance obtained by means of a crystalline detector and head telephone as previously mentioned.

The wave-length of a Marconi aerial may be obtained by means of the connections shown in Fig. 6-A. Here the antenna system set is set into oscillation by means of a properly adjusted buzzer in connection with the battery as shown. When the buzzer is set into operation a change in the lines of force of the inductance coil, L', takes place; consequently the aerial system is charged and discharged at its own natural period of vibration.

The oscillations thus produced act upon the coil, L, of the wave-meter and resonance is indicated by means of the crystal detector and head telephones. For accuracy the coil L should be very loosely coupled to L'.

When the closed and open oscillatory circuits of a wireless telegraph transmitter are so related that energy is transferred from one to the other, they are said to be coupled. It is a matter of importance in such circuits that the exact value of coupling be known. This value may be determined by the resultant wave-lengths or frequencies produced in the circuits. Referring to Fig. 7: When the inductance coil, L-2, is placed in inductive relation to L-3, energy is transferred in the well-known manner. If the coil, L-3, is placed in close inductive

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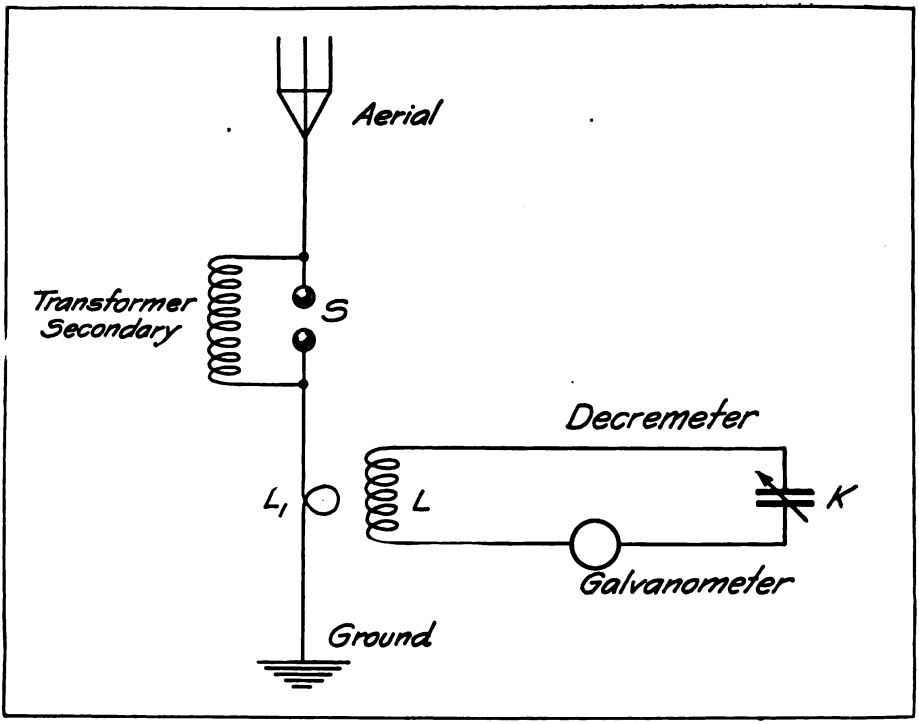


Fig. 6

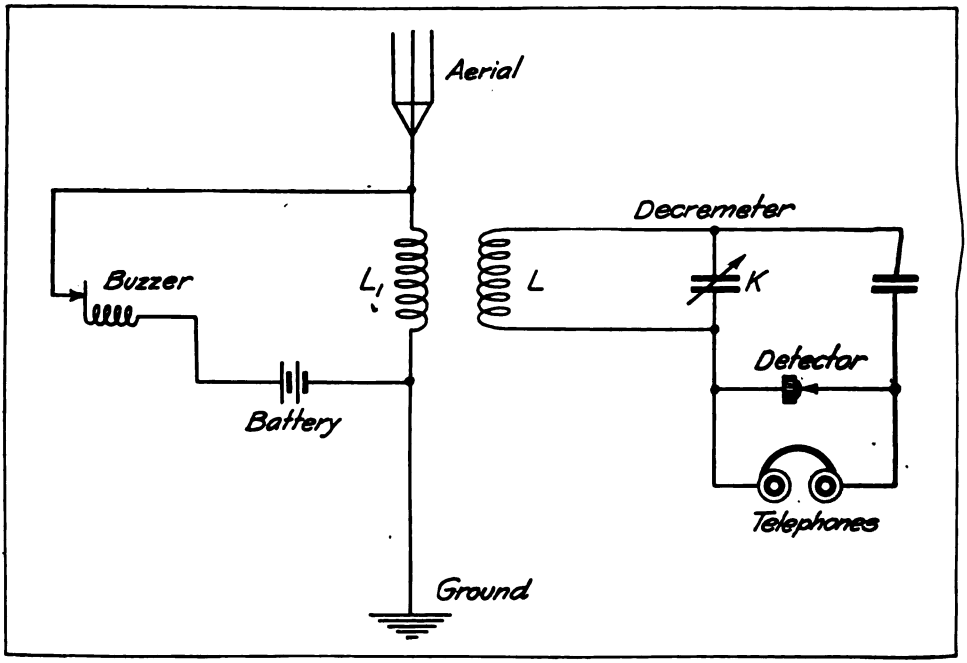


Fig. 6A

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relation to L-2 two resultant wave-lengths widely separated are set up. If, however, the coil, L-3, is drawn away from L-2 the two frequencies tend to approach unity.

The transmitter being set into operation, the inductance coil, L, of the wave-meter is placed in inductive relation to L', a single turn of wire connected in series with the earth lead; the capacity of the condenser of the wave-meter, K, is altered and two points of maximum deflection are noted on the galvanometer.

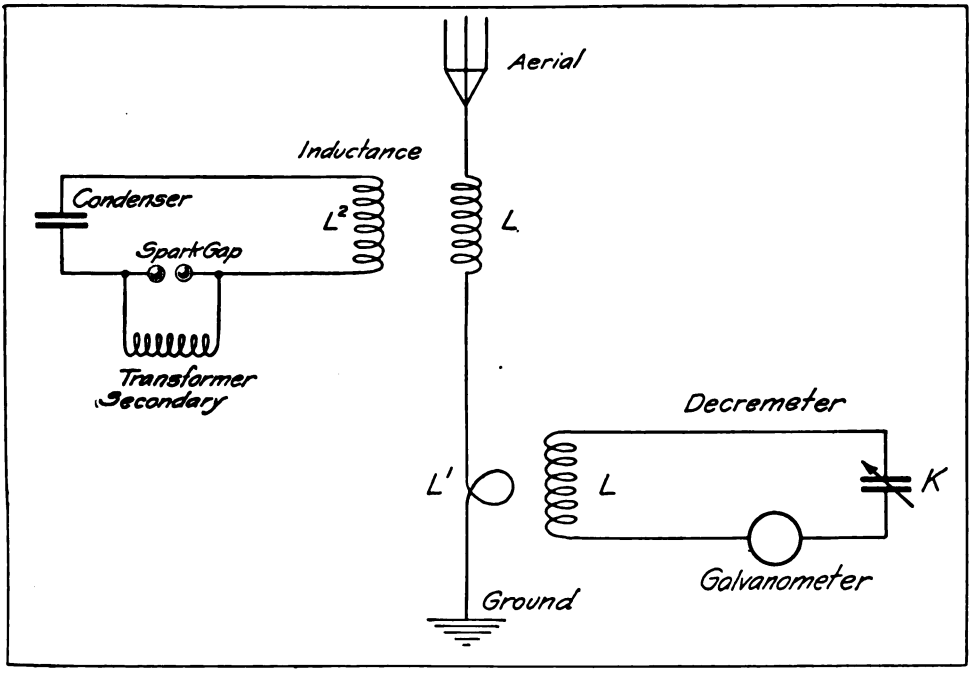


*Fig. 7*

The corresponding wave-length readings are then substituted in the following formula:

$$K = \frac{\lambda_1^2 - \lambda_2^2}{\lambda_1^2 + \lambda_2^2} \qquad (4)$$

where $\lambda$ equals the longer wave-length and $\lambda_2$ the shorter wave-length.

If the wave-length ($\lambda$) to which both circuits have been independently adjusted is known, then the following formula will give sufficiently accurate values of the resultant coupling, namely:

$$K = \frac{\lambda_1 - \lambda_2}{\lambda} \qquad (5)$$

where K = coefficient of coupling.

If the galvanometer readings thus obtained are plotted against the corresponding wave-length readings, a complete curve will result showing two maxima. This curve is known as a coupling curve.

If K has a value near to zero, there will be only one maximum in the resultant curve and the emitted wave-length will be practically that of the independent circuits.

When two oscillatory circuits of radio frequency are magnetically coupled the combined decrement value is obtained from the following formula:

$$\delta_1 + \delta_2 \pi = \left(1 - \frac{\lambda}{\lambda_r}\right) \frac{a}{\sqrt{A^2 - a^2}} \qquad (6)$$

Where, in this particular application,

$\delta_1$ = the decrement of the circuit under measurement;

$\delta_2$ = the decrement of the decremeter circuit;

$\lambda_r$ = the wave-length at resonance;

$\lambda$ = the wave-length at a frequency a certain percentage off resonance (not over 5 per cent.)

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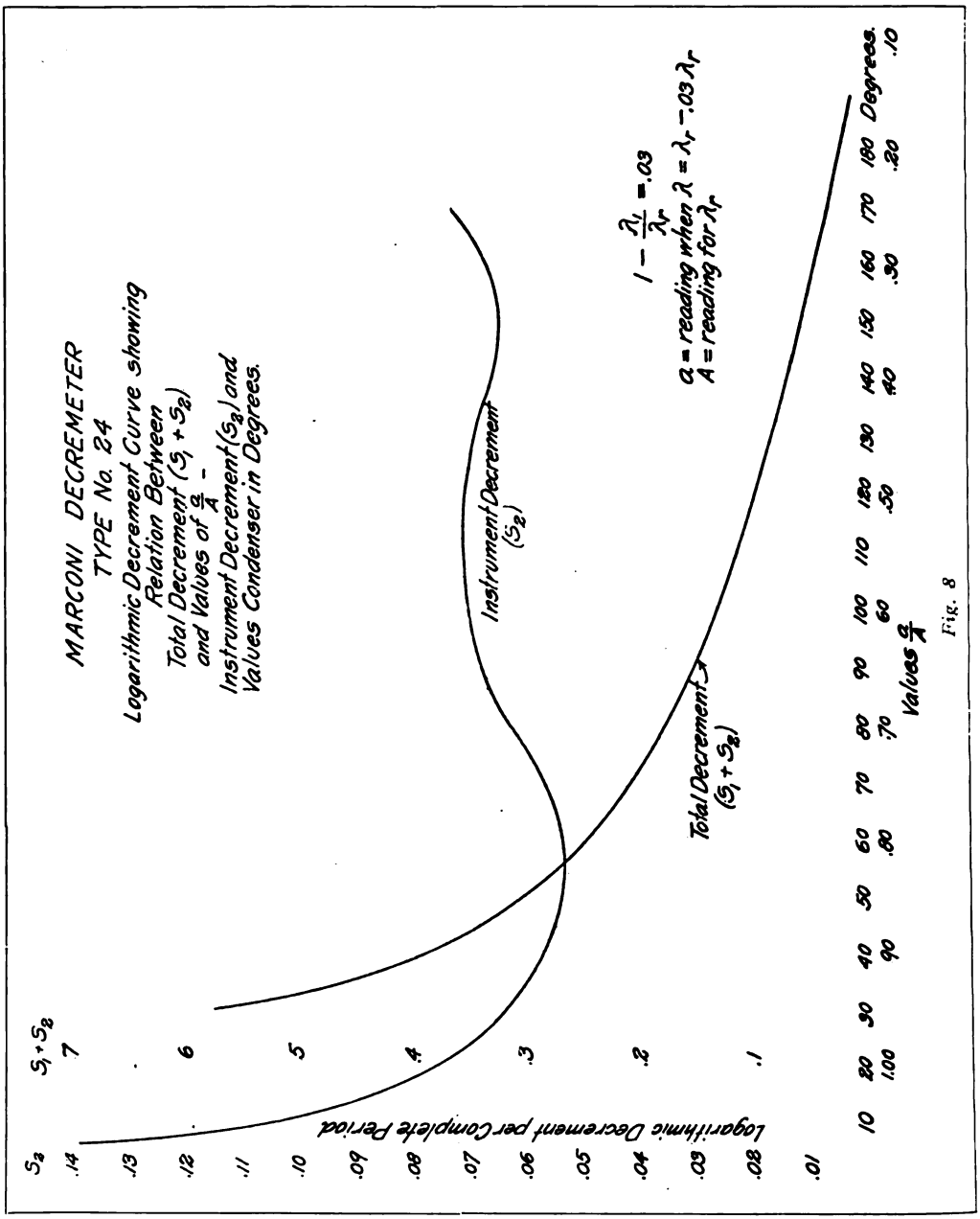


Fig. 8

A = the corresponding current reading at the galvanometer of the wave-meter when the latter is adjusted to $\lambda_r$;

a = the galvanometer reading corresponding to $\lambda$.

If we substitute X for the expression:

$$\left(1 - \frac{\lambda}{\lambda_r}\right)$$

and Y for $\frac{a}{A}$ then Formula No. 6 becomes

$$\delta_1 + \delta_2 = 3.1416 \times \frac{y}{\sqrt{1 - y^2}} \qquad (7)$$

If the decrement of the decremeter circuit is definitely known at various capaci-

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ties of the variable condenser, this value may be subtracted from that given in equation No. 7, and the result is the decrement of the circuit under measurement.

To determine the decrement of the emitted wave of a wireless telegraph transmitter, the inductance coil of the decremeter is placed in inductive relation to the earth leads of the aerial system as shown in Fig. 7. The capacity of the wave-meter condenser is then altered until resonance is obtained as indicated by the galvanometer.

Let the wave-length found be $\lambda_r$ and the corresponding current reading A. Then set the condenser of the decremeter at a point so that X or $\left(1 - \frac{\lambda}{\lambda_r}\right)$ equals

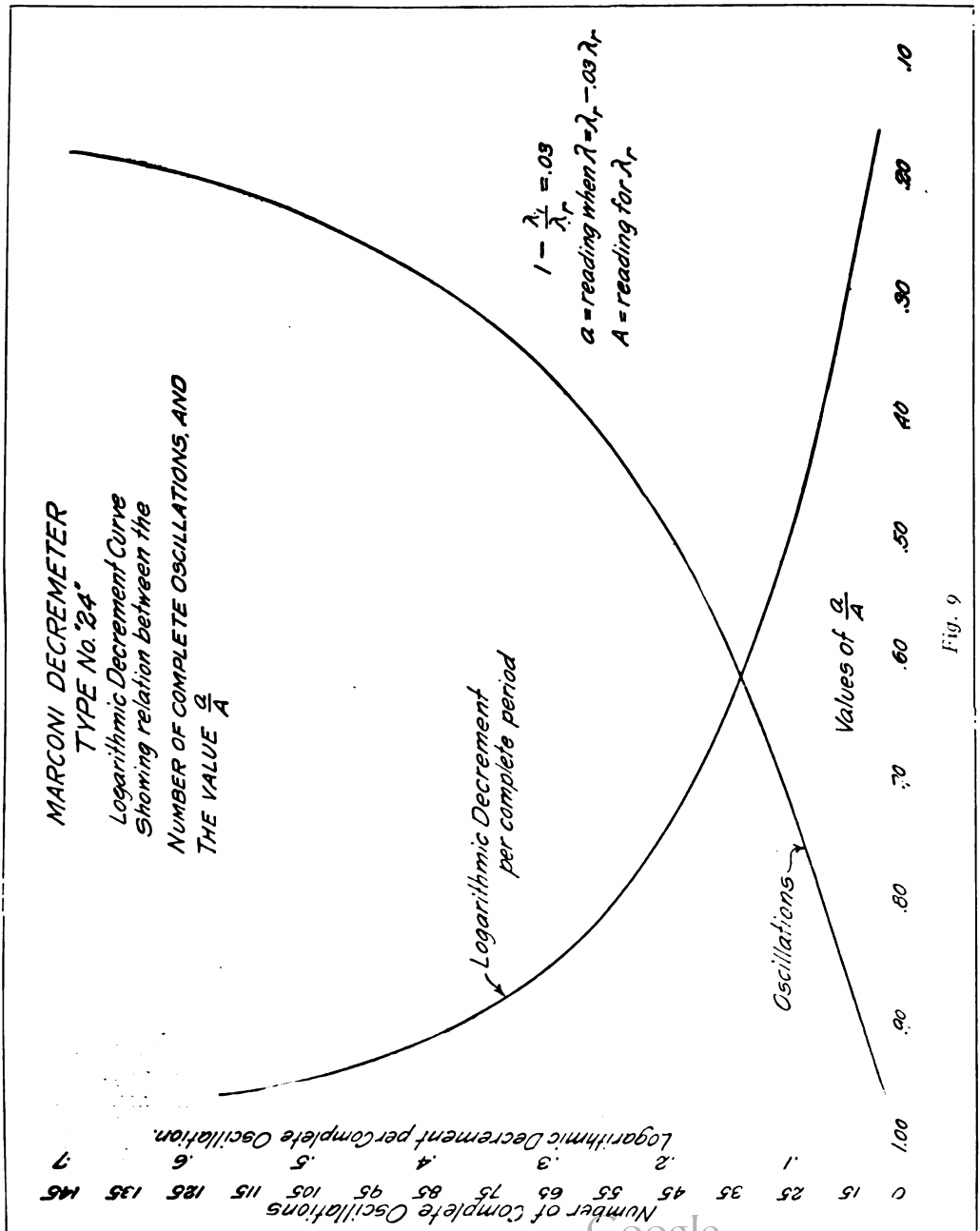
MARCONI DECREMETER
TYPE No. "24"
Logarithmic Decrement Curve
Showing relation between the
NUMBER OF COMPLETE OSCILLATIONS AND
THE VALUE $\frac{a}{A}$
$1 - \frac{\lambda}{\lambda_r} = .03$
a = reading when $\lambda = \lambda_r - .03\lambda_r$
A = reading for $\lambda_r$
Logarithmic Decrement per complete period
Oscillations
Values of $\frac{a}{A}$
Number of complete Oscillations
Logarithmic Decrement per Complete Oscillation.
0 15 25 35 45 55 65 75 85 95 105 115 125 135 145
.1 .2 .3 .4 .5 .6 .7
1.00 .90 .80 .70 .60 .50 .40 .30 .20 .10

Fig. 9

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one, two, three, four or five per cent., as desired, and let the corresponding current ratio be y or $\frac{a}{A}$. Substitution of these values in formula No. 7, the combined decrement of the circuit under measurement is obtained.

For accuracy, several values of

$$\left(1 - \frac{\lambda}{\lambda_r}\right)$$

should be selected and corresponding ratio of $\frac{a}{A}$ noted. A mean of these readings is taken to obtain the value of $\delta_1 + \delta_2$. The value of $\delta_2$ being known, the value of $\delta_1$ is quickly obtained.

If a number of decrement values for given values of $\left(1 - \frac{\lambda}{\lambda_r}\right)$ and corresponding ratio of $\frac{a}{A}$ are calculated, the resultant data may be plotted in curve form for rapid determination of the decrement of a circuit by means of the current readings from the galvanometer alone.

A curve of this character is given in Fig. 8, which, when used in connection with decremeter No. 24, allows determination of the decrement to be made as follows:

The decremeter is adjusted to resonance with the circuit under measurement and the inductance coil of the wave-meter placed in such position or relation to the circuit under measurement as to give a reading on the hot wire galvanometer of 100. The condenser of the wave-meter is then adjusted to a point three per cent. off resonance and the corresponding deflection on the galvanometer noted. In this manner the ratio $\frac{a}{A}$ is quickly determined and by reference to Fig. 8, the corresponding decrement value obtained. The value of $\delta_2$ being indicated directly upon the decremeter scale, it may be subtracted from the combined value just obtained to find the value of $\delta_1$.

It is frequently observed that the resonance curves of an oscillatory circuit are non-uniform and in consequence it is well to take decrement readings 3 per cent. above resonance as well as below resonance. A mean of the two readings gives the final decrement value.

The value of $\delta_1$ having thus been obtained, the number of complete oscillations per wave train can be determined from the curve (Fig. 8), or by the following formula:

$$N = \frac{4.605 \times \delta_1}{2\,\delta_1}$$

Where N = the number of oscillations taking place before the last one is reduced to 1 per cent. of the first, and $\delta_1$ is the decrement of the circuit being measured.

The value of $\delta_1$ can also be determined from the capacity values of the variable condenser, as follows: Adjust the variable condenser for resonance and vary the inductive relation between the decremeter and the circuit under measurement until the galvanometer reading is 100. Then decrease the capacity until the galvanometer reads 70.7 and note the corresponding capacity of the condenser. Let this capacity be represented by C; next increase the capacity of the condenser at a point beyond resonance until the galvanometer again reads 70.7 and note the corresponding capacity. Let this capacity be C'. If the capacity of the condenser when adjusted for resonance is $C_r$, then

$$\delta_1 = \left(\frac{C_1 - C}{C_r} \times \frac{\pi}{2}\right) - \delta_2.$$

Where $\delta_2$ is the decrement of the instrument taken from the scale marked $\delta_1$ when the condenser pointer is adjusted for resonance.

In the Fig. 9 two curves are given, one curve being the ratio of $\frac{a}{A}$ plotted against the values of $\delta_1 + \delta_2$, the total decrement. In the second curve the degrees of the condenser scale are plotted against $\delta_2$ the decrement of the instrument. These curves can be employed for determination of the decrement in place of the curves given in Fig. 8.

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## NO. 24 WAVEMETER TABLES.

$\lambda$ = Wave-length in Meters.

$\lambda^2$ = Wave-length Squared.

n = Number of oscillations per second.

O = L.K. and is called the oscillation constant.

K = Capacity in Microfarads.

L = Inductance in Centimeters—1,000 Cent. = 1 Microhenry.

D = Difference of L.K. for 1 meter.

| $\lambda$ | $\lambda^2$ | n | O or $\sqrt{L.K.}$ | L.K. | D. |
|---|---|---|---|---|---|
| 100 | 10,000 | 3000000 | 1.68 | 2.82 | .042 |
| 110 | 12,100 | 2727272 | 1.80 | 3.24 | .084 |
| 120 | 14,400 | 2500000 | 2.02 | 4.08 | .067 |
| 130 | 16,900 | 2307600 | 2.18 | 4.75 | .077 |
| 140 | 19,600 | 2142600 | 2.35 | 5.52 | .083 |
| 150 | 22,500 | 2000000 | 2.52 | 6.35 | .081 |
| 160 | 25,600 | 1874800 | 2.68 | 7.16 | .096 |
| 170 | 28,900 | 1764600 | 2.85 | 8.12 | .10 |
| 180 | 32,400 | 1666600 | 3.02 | 9.12 | .105 |
| 190 | 36,100 | 1578800 | 3.19 | 10.17 | .112 |
| 200 | 40,000 | 1500000 | 3.36 | 11.29 | .11 |
| 210 | 44,100 | 1428400 | 3.52 | 12.39 | .123 |
| 220 | 48,400 | 1363500 | 3.69 | 13.62 | .128 |
| 230 | 52,900 | 1304200 | 3.86 | 14.90 | .134 |
| 240 | 57,600 | 1250000 | 4.03 | 16.24 | .131 |
| 250 | 62,500 | 1200000 | 4.19 | 17.55 | .146 |
| 260 | 67,600 | 1153800 | 4.36 | 19.01 | .15 |
| 270 | 72,900 | 1111000 | 4.53 | 20.52 | .157 |
| 280 | 78,400 | 1071300 | 4.70 | 22.09 | .163 |
| 290 | 84,100 | 1034300 | 4.87 | 23.72 | .158 |
| 300 | 90,000 | 1000000 | 5.03 | 25.30 | .174 |
| 310 | 96,100 | 967700 | 5.20 | 27.04 | .18 |
| 320 | 102,400 | 937400 | 5.37 | 28.84 | .185 |
| 330 | 108,900 | 909100 | 5.54 | 30.69 | .18 |
| 340 | 115,600 | 882300 | 5.70 | 32.49 | .197 |
| 350 | 122,500 | 857100 | 5.87 | 34.46 | .20 |
| 360 | 129,600 | 833300 | 6.04 | 36.48 | .208 |
| 370 | 136,900 | 810800 | 6.21 | 38.56 | .215 |
| 380 | 144,400 | 789400 | 6.38 | 40.71 | .206 |
| 390 | 152,100 | 769200 | 6.54 | 42.77 | .226 |

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## No. 24 Wavemeter Tables

| λ | $\lambda^2$ | n | O or $\sqrt{L.K.}$ | L.K. | D. |
|---|---|---|---|---|---|
| 400 | 160,000 | 750000 | 6.71 | 45.03 | .23 |
| 410 | 168,100 | 731700 | 6.88 | 47.33 | .237 |
| 420 | 176,400 | 714300 | 7.05 | 49.70 | .228 |
| 430 | 184,900 | 697700 | 7.21 | 51.98 | .248 |
| 440 | 193,600 | 681800 | 7.38 | 54.46 | .254 |
| 450 | 202,500 | 666700 | 7.55 | 57.00 | .26 |
| 460 | 211,600 | 652200 | 7.72 | 59.60 | .265 |
| 470 | 220,900 | 638300 | 7.89 | 62.25 | .255 |
| 480 | 230,400 | 625000 | 8.05 | 64.80 | .277 |
| 490 | 240,100 | 612200 | 8.22 | 67.57 | .282 |
| 500 | 250,000 | 600000 | 8.39 | 70.39 | .288 |
| 510 | 260,100 | 588200 | 8.56 | 73.27 | .277 |
| 520 | 270,400 | 576900 | 8.72 | 76.04 | .299 |
| 530 | 280,900 | 566000 | 8.89 | 79.03 | .305 |
| 540 | 291,600 | 555600 | 9.06 | 82.08 | .311 |
| 550 | 302,500 | 545400 | 9.23 | 85.19 | .317 |
| 560 | 313,600 | 535700 | 9.40 | 88.36 | .303 |
| 570 | 324,900 | 526300 | 9.56 | 91.39 | .328 |
| 580 | 336,400 | 517200 | 9.73 | 94.67 | .334 |
| 590 | 348,100 | 508500 | 9.90 | 98.01 | .340 |
| 600 | 360,000 | 500000 | 10.07 | 101.41 | .324 |
| 610 | 372,100 | 491800 | 10.23 | 104.65 | .35 |
| 620 | 384,400 | 483900 | 10.40 | 108.15 | .358 |
| 630 | 396,900 | 476200 | 10.57 | 111.73 | .362 |
| 640 | 409,600 | 486800 | 10.74 | 115.35 | .346 |
| 650 | 422,500 | 461500 | 10.90 | 118.81 | .373 |
| 660 | 435,600 | 454600 | 11.07 | 122.54 | .380 |
| 670 | 448,900 | 447800 | 11.24 | 126.34 | .385 |
| 680 | 462,400 | 441200 | 11.41 | 130.19 | .391 |
| 690 | 476,100 | 434800 | 11.58 | 134.10 | .373 |
| 700 | 490,000 | 428600 | 11.74 | 137.83 | .403 |
| 710 | 504,100 | 422500 | 11.91 | 141.86 | .407 |
| 720 | 518,400 | 416700 | 12.08 | 145.93 | .414 |
| 730 | 532,900 | 411000 | 12.25 | 150.07 | .394 |
| 740 | 547,600 | 405400 | 12.41 | 154.01 | .426 |
| 750 | 562,500 | 400000 | 12.58 | 158.27 | .430 |
| 760 | 577,600 | 394800 | 12.75 | 162.57 | .426 |
| 770 | 592,900 | 389600 | 12.92 | 166.83 | .443 |
| 780 | 608,400 | 384600 | 13.09 | 171.35 | .432 |
| 790 | 624,100 | 379800 | 13.25 | 175.57 | .453 |
| 800 | 640,000 | 375000 | 13.42 | 180.10 | .459 |
| 810 | 656,100 | 370400 | 13.59 | 184.69 | .464 |
| 820 | 672,400 | 365900 | 13.76 | 189.33 | .472 |
| 830 | 688,900 | 361400 | 13.93 | 194.05 | .448 |
| 840 | 705,600 | 357100 | 14.09 | 198.53 | .482 |

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## No. 24 WAVEMETER TABLES

| λ | λ² | n | O or $\sqrt{L.K.}$ | L.K. | D. |
|---|---|---|---|---|---|
| 850 | 722,500 | 352900 | 14.26 | 203.35 | .489 |
| 860 | 739,600 | 348800 | 14.43 | 208.24 | .493 |
| 870 | 756,900 | 344800 | 14.60 | 213.17 | .469 |
| 880 | 774,400 | 340900 | 14.76 | 217.86 | .504 |
| 890 | 792,100 | 337100 | 14.93 | 222.90 | .511 |
| 900 | 810,000 | 333300 | 15.10 | 228.01 | .516 |
| 910 | 828,100 | 329700 | 15.27 | 233.17 | .492 |
| 920 | 846,400 | 326100 | 15.43 | 238.09 | .527 |
| 930 | 864,900 | 322600 | 15.60 | 243.36 | .534 |
| 940 | 883,600 | 319100 | 15.77 | 248.70 | .538 |
| 950 | 902,500 | 315800 | 15.94 | 254.08 | .545 |
| 960 | 921,600 | 312500 | 16.11 | 259.53 | .518 |
| 970 | 940,900 | 309300 | 16.27 | 264.71 | .567 |
| 980 | 960,400 | 306100 | 16.44 | 270.38 | .552 |
| 990 | 980,100 | 303000 | 16.61 | 275.90 | .567 |
| 1000 | 1000,000 | 300000 | 16.78 | 281.57 | .543 |
| 1010 | 1020,100 | 297030 | 16.94 | 287.00 | .570 |
| 1020 | 1040,400 | 294120 | 17.11 | 292.70 | .590 |
| 1030 | 1060,900 | 291260 | 17.28 | 298.60 | .590 |
| 1040 | 1081,600 | 288450 | 17.45 | 304.50 | .60 |
| 1050 | 1102,550 | 285710 | 17.62 | 310.50 | .56 |
| 1060 | 1123,600 | 283010 | 17.78 | 316.10 | .61 |
| 1070 | 1144,900 | 280370 | 17.95 | 322.20 | .61 |
| 1080 | 1166,400 | 277780 | 18.12 | 328.30 | .62 |
| 1090 | 1188,100 | 275230 | 18.29 | 334.50 | .59 |
| 1100 | 1210,000 | 272730 | 18.45 | 340.40 | .63 |
| 1110 | 1232,100 | 270270 | 18.62 | 346.70 | .64 |
| 1120 | 1254,400 | 267850 | 18.79 | 353.10 | .64 |
| 1130 | 1276,900 | 265480 | 18.96 | 359.50 | .65 |
| 1140 | 1299,600 | 263150 | 19.13 | 366.00 | .61 |
| 1150 | 1322,500 | 260860 | 19.29 | 372.10 | .66 |
| 1160 | 1345,600 | 258610 | 19.46 | 378.70 | .66 |
| 1170 | 1368,900 | 256400 | 19.63 | 385.30 | .68 |
| 1180 | 1392,400 | 254230 | 19.80 | 392.10 | .67 |
| 1190 | 1416,100 | 252100 | 19.97 | 398.80 | .64 |
| 1200 | 1224,000 | 250000 | 20.13 | 405.20 | .69 |
| 1210 | 1464,100 | 247930 | 20.30 | 412.10 | .69 |
| 1220 | 1488,400 | 245900 | 20.47 | 419.00 | .70 |
| 1230 | 1512,900 | 243900 | 20.64 | 426.00 | .66 |
| 1240 | 1537,600 | 241930 | 20.80 | 432.60 | .71 |
| 1250 | 1562,500 | 240000 | 20.97 | 439.70 | .72 |
| 1260 | 1587,600 | 238090 | 21.14 | 446.90 | .72 |
| 1270 | 1612,900 | 236220 | 21.31 | 454.10 | .69 |
| 1280 | 1638,400 | 234370 | 21.47 | 461.00 | .73 |
| 1290 | 1664,100 | 232560 | 21.64 | 468.30 | .74 |

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## No. 24 WAVEMETER TABLES

| λ | λ² | n | O or √L.K. | L.K. | D. |
|---|---|---|---|---|---|
| 1300 | 1,690,000 | 230760 | 21.81 | 475.70 | .74 |
| 1310 | 1,716,000 | 229010 | 21,98 | 483.10 | .75 |
| 1320 | 1,742,400 | 227270 | 22.15 | 490.60 | .72 |
| 1330 | 1,768,900 | 225560 | 22.31 | 497.80 | .75 |
| 1340 | 1,795,600 | 223870 | 22.48 | 505.30 | .77 |
| 1350 | 1,822,500 | 222220 | 22.65 | 513.00 | .78 |
| 1360 | 1,849,600 | 220590 | 22.82 | 520.80 | .73 |
| 1370 | 1,876,900 | 218970 | 22.98 | 528.10 | .78 |
| 1380 | 1,904,400 | 217390 | 23.15 | 535.90 | .79 |
| 1390 | 1,932,100 | 215830 | 23.32 | 543.80 | .80 |
| 1400 | 1,960,000 | 214380 | 23.49 | 551.80 | .80 |
| 1410 | 1,988,100 | 212760 | 23.66 | 559.80 | .76 |
| 1420 | 2,016,400 | 211260 | 23.82 | 567.40 | .81 |
| 1430 | 2,044,900 | 209790 | 23.99 | 575.50 | .82 |
| 1440 | 2,073,600 | 208340 | 24.16 | 583.70 | .82 |
| 1450 | 2,102,500 | 206900 | 24.33 | 591.90 | .79 |
| 1460 | 2,131,600 | 205470 | 24.49 | 599.80 | .83 |
| 1470 | 2,160,900 | 204080 | 24.66 | 608.10 | .84 |
| 1480 | 2,190,400 | 202700 | 24.83 | 616.50 | .85 |
| 1490 | 2,220,100 | 201340 | 25.00 | 625.00 | .80 |
| 1500 | 2,250,000 | 200000 | 25.17 | 633.50 | .81 |
| 1510 | 2,280,100 | 198680 | 25.33 | 641.60 | .86 |
| 1520 | 2,310,400 | 197360 | 25.50 | 650.20 | .88 |
| 1530 | 2,340,900 | 196070 | 25.67 | 659.00 | .87 |
| 1540 | 2,371,600 | 194800 | 25.84 | 667.70 | .83 |
| 1550 | 2,402,500 | 193540 | 26.00 | 676.00 | .89 |
| 1560 | 2,433,600 | 192310 | 26.17 | 684.90 | .89 |
| 1570 | 2,464,900 | 191060 | 26.34 | 693.80 | .90 |
| 1580 | 2,496,400 | 189860 | 26.51 | 702.80 | .90 |
| 1590 | 2,528,100 | 188670 | 26.68 | 711.80 | .86 |
| 1600 | 2,560,000 | 187500 | 26.84 | 720.40 | .91 |
| 1610 | 2,592,100 | 186340 | 27.01 | 729.50 | .92 |
| 1620 | 2,624,400 | 185190 | 27.18 | 738.70 | .93 |
| 1630 | 2,656,900 | 184050 | 27.35 | 748.00 | .93 |
| 1640 | 2,689,600 | 182930 | 27.52 | 757.30 | .89 |
| 1650 | 2,722,500 | 181820 | 27.68 | 766.20 | .94 |
| 1660 | 2,755,600 | 180730 | 27.85 | 775.60 | .96 |
| 1670 | 2,788,900 | 179640 | 28.02 | 785.20 | .94 |
| 1680 | 2,822,400 | 178570 | 28.19 | 794.60 | .91 |
| 1690 | 2,856,100 | 177510 | 28.35 | 803.70 | .97 |
| 1700 | 2,890,000 | 176460 | 28.52 | 813.40 | .97 |
| 1710 | 2,924,100 | 175440 | 28.69 | 823.10 | .98 |
| 1720 | 2,958,400 | 174420 | 28.86 | 832.90 | .93 |
| 1730 | 2,992,900 | 173410 | 29.02 | 842.20 | .98 |

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## No. 24 WAVEMETER TABLES

| λ | $\lambda^2$ | n | O or $\sqrt{L.K.}$ | L.K. | D. |
|---|---|---|---|---|---|
| 1740 | 3,026,600 | 172410 | 29.19 | 852.00 | 1.00 |
| 1750 | 3,062,500 | 171430 | 29.36 | 862.00 | 1.00 |
| 1760 | 3,097,600 | 170450 | 29.53 | 872.00 | 1.00 |
| 1770 | 3,132,900 | 169490 | 29.70 | 882.10 | .95 |
| 1780 | 3,168,400 | 168540 | 29.86 | 981.60 | 1.02 |
| 1790 | 3,204,100 | 167600 | 30.03 | 901.80 | .92 |
| 1800 | 3,240,000 | 166670 | 30.20 | 912.00 | 1.03 |
| 1810 | 3,276,100 | 165750 | 30.37 | 922.30 | 1.04 |
| 1820 | 3,312,400 | 164840 | 30.54 | 932.70 | .98 |
| 1830 | 3,348,900 | 163940 | 30.70 | 942.50 | 1.05 |
| 1840 | 3,385,600 | 163040 | 30.87 | 953.00 | 1.04 |
| 1850 | 3,422,500 | 162160 | 31.04 | 963.40 | 1.06 |
| 1860 | 3,459,600 | 161290 | 31.21 | 974.10 | 1.00 |
| 1870 | 3,496,900 | 150430 | 31.37 | 984.10 | 1.07 |
| 1880 | 3,534,400 | 159370 | 31.54 | 994.80 | 1.08 |
| 1890 | 3,572,100 | 158730 | 31.71 | 1005.60 | 1.08 |
| 1900 | 3,610,000 | 157890 | 31.88 | 1016.40 | 1.02 |
| 1910 | 3,648,100 | 157060 | 32.04 | 1026.60 | 1.09 |
| 1920 | 3,686,400 | 156240 | 32.21 | 1037.50 | 1.10 |
| 1930 | 3,724,900 | 155440 | 32.35 | 1048.50 | 1.14 |
| 1940 | 3,763,600 | 154630 | 32.55 | 1059.90 | 1.07 |
| 1950 | 3,802,500 | 153840 | 32.72 | 1070.60 | 1.05 |
| 1960 | 3,841,600 | 153060 | 32.88 | 1081.10 | 1.12 |
| 1970 | 3,880,900 | 152280 | 33.05 | 1092.30 | 1.12 |
| 1980 | 3,920,400 | 151510 | 33.22 | 1103.50 | 1.14 |
| 1990 | 3,960,100 | 150750 | 33.39 | 1114.90 | 1.07 |
| 2000 | 4,000,000 | 150000 | 33.55 | 1125.60 | 1.15 |
| 2010 | 4,040,100 | 149250 | 33.72 | 1137.10 | 1.25 |
| 2020 | 4,080,400 | 148520 | 33.89 | 1149.60 | 1.05 |
| 2030 | 4,120,900 | 147780 | 34.06 | 1160.10 | 1.16 |
| 2040 | 4,166,600 | 147060 | 34.23 | 1171.70 | 1.10 |
| 2050 | 4,202,500 | 146340 | 34.39 | 1182.70 | 1.17 |
| 2060 | 4,243,600 | 145630 | 34.56 | 1194.40 | 1.18 |
| 2070 | 4,284,900 | 144930 | 34.73 | 1206.20 | 1.18 |
| 2080 | 4,326,400 | 144230 | 34.90 | 1218.00 | 1.18 |
| 2090 | 4,368,100 | 143540 | 35.07 | 1229.80 | 1.14 |
| 2100 | 4,410,000 | 142850 | 35.23 | 1241.20 | 1.20 |
| 2110 | 4,452,100 | 142180 | 35.40 | 1253.20 | 1.21 |
| 2120 | 4,494,400 | 141510 | 35.57 | 1265.30 | 1.21 |
| 2130 | 4,536,900 | 140840 | 35.74 | 1277.40 | 1.15 |
| 2140 | 4,579,600 | 140180 | 35.90 | 1288.90 | 1.22 |
| 2150 | 4,622,500 | 139540 | 36.07 | 1301.10 | 1.23 |
| 2160 | 4,665,600 | 138880 | 36.24 | 1313.40 | 1.23 |
| 2170 | 4,708,900 | 138240 | 36.41 | 1325.70 | 1.24 |
| 2180 | 4,752,400 | 137610 | 36.58 | 1338.10 | 1.17 |
| 2190 | 4,796,100 | 136980 | 36.74 | 1349.80 | 1.26 |

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## No. 24 WAVEMETER TABLES

| λ | λ² | n | O or $\sqrt{L.K.}$ | L.K. | D. |
|---|---|---|---|---|---|
| 2200 | 4,840,000 | 136360 | 36.91 | 1362.40 | 1.25 |
| 2210 | 4,844,100 | 135740 | 37.08 | 1374.90 | 1.26 |
| 2220 | 4,928,400 | 135130 | 37.25 | 1387.50 | 1.19 |
| 2230 | 4,972,900 | 134530 | 37.41 | 1399.40 | 1.28 |
| 2240 | 5,017,600 | 133930 | 37.58 | 1412.20 | 1.29 |
| 2250 | 5,062,500 | 133330 | 37.75 | 1425.10 | 1.29 |
| 2260 | 5,107,600 | 132740 | 37.92 | 1438.00 | 1.22 |
| 2270 | 5,152,900 | 132160 | 38.08 | 1450.20 | 1.29 |
| 2280 | 5,198,400 | 131570 | 38.25 | 1463.10 | 1.31 |
| 2290 | 5,244,100 | 131000 | 38.42 | 1476.20 | 1.31 |
| 2300 | 5,290,000 | 130430 | 38.59 | 1489.30 | 1.31 |
| 2310 | 5,336,100 | 129870 | 38.76 | 1502.40 | 1.32 |
| 2320 | 5,382,400 | 129310 | 38.93 | 1515.60 | 1.25 |
| 2330 | 5,428,900 | 128750 | 39.09 | 1528.10 | 1.33 |
| 2340 | 5,475,600 | 128200 | 39.26 | 1541.40 | 1.33 |
| 2350 | 5,522,500 | 127660 | 39.43 | 1554.70 | 1.34 |
| 2360 | 5,569,600 | 127120 | 39.60 | 1568.10 | 1.27 |
| 2370 | 5,616,900 | 126580 | 39.76 | 1580.80 | 1.37 |
| 2380 | 5,644,400 | 126050 | 39.93 | 1594.50 | 1.35 |
| 2390 | 5,712,100 | 125520 | 40.10 | 1608.00 | 1.45 |
| 2400 | 5,760,000 | 125000 | 40.27 | 1621.80 | 1.45 |
| 2410 | 5,808,100 | 124480 | 40.45 | 1636.30 | 1.21 |
| 2420 | 5,856,400 | 123960 | 40.60 | 1648.40 | 1.39 |
| 2330 | 5,904,900 | 123450 | 40.77 | 1662.30 | 1.38 |
| 2440 | 5,953,600 | 122950 | 40.94 | 1676.10 | 1.39 |
| 2450 | 6,002,500 | 122450 | 41.11 | 1690.00 | 1.33 |
| 2460 | 6,051,600 | 121950 | 41.27 | 1703.30 | 1.40 |
| 2470 | 6,100,900 | 121450 | 41.44 | 1717.30 | 1.41 |
| 2480 | 6,150,400 | 120960 | 41.64 | 1731.40 | 1.40 |
| 2490 | 6,200,100 | 120480 | 41.78 | 1745.40 | 1.43 |
| 2500 | 6,250,000 | 120000 | 41.95 | 1759.70 | 1.36 |
| 2510 | 6,300,100 | 119520 | 42.11 | 1773.30 | 1.42 |
| 2520 | 6,350,400 | 119050 | 42.28 | 1787.50 | 1.45 |
| 2530 | 6,400,900 | 118580 | 42.45 | 1802.00 | 1.44 |
| 2540 | 6,451,600 | 118120 | 42.62 | 1816.40 | 1.46 |
| 2550 | 6,502,500 | 117650 | 42.79 | 1831.00 | 1.38 |
| 2560 | 6,553,600 | 117190 | 42.95 | 1844.80 | 1.46 |
| 2570 | 6,504,900 | 116730 | 43.12 | 1859.40 | 1.46 |
| 2580 | 6,656,400 | 116280 | 43.29 | 1874.00 | 1.47 |
| 2590 | 6,708,100 | 115830 | 43.46 | 1888.70 | 1.39 |
| 2600 | 6,760,000 | 115380 | 43.62 | 1902.60 | 1.49 |
| 2610 | 6,812,100 | 114940 | 43.79 | 1917.50 | 1.48 |
| 2620 | 6,864,400 | 114510 | 43.96 | 1932.30 | 1.51 |
| 2630 | 6,916,900 | 114070 | 44.13 | 1947.40 | 1.42 |

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## No. 24 WAVEMETER TABLES

| λ | λ² | n | O or √L.K. | L.K. | D. |
|---|---|---|---|---|---|
| 2640 | 6,969,600 | 113640 | 44.29 | 1961.60 | 1.50 |
| 2650 | 7,022,500 | 113210 | 44.46 | 1976.60 | 1.51 |
| 2660 | 7,075,600 | 112780 | 44.63 | 1991.70 | 1.53 |
| 2670 | 7,128,900 | 112360 | 44.80 | 2007.00 | 1.53 |
| 2680 | 7,182,400 | 111940 | 44.97 | 2022.30 | 1.43 |
| 2690 | 7,236,100 | 111530 | 45.13 | 2036.60 | 1.54 |
| 2700 | 7,290,000 | 111110 | 45.30 | 2052.00 | 1.54 |
| 2710 | 7,344,100 | 110700 | 45.47 | 2067.40 | 1.56 |
| 2720 | 7,398,400 | 110290 | 45.64 | 2083.00 | 1.47 |
| 2730 | 7,452,900 | 109890 | 45.80 | 2097.70 | 1.54 |
| 2740 | 7,507,600 | 109490 | 45.97 | 2113.10 | 1.58 |
| 2750 | 7,562,500 | 109090 | 46.14 | 2128.90 | 1.58 |
| 2760 | 7,617,600 | 108700 | 46.31 | 2144.70 | 1.48 |
| 2770 | 7,672,900 | 108300 | 46.47 | 2159.50 | 1.57 |
| 2780 | 7,728,400 | 107920 | 46.64 | 2175.20 | 1.59 |
| 2790 | 7,784,100 | 107530 | 46.81 | 2191.10 | 1.59 |
| 2800 | 7,840,000 | 107140 | 46.98 | 2207.00 | 1.60 |
| 2810 | 7,896,100 | 106760 | 47.15 | 2223.00 | 1.62 |
| 2820 | 7,952,400 | 106380 | 47.32 | 2239.20 | 1.52 |
| 2830 | 8,008,900 | 106010 | 47.48 | 2254.40 | 1.62 |
| 2840 | 8,065,600 | 105630 | 47.65 | 2270.60 | 1.63 |
| 2850 | 8,122,500 | 105260 | 47.82 | 2286.90 | 1.62 |
| 2860 | 8,179,600 | 104890 | 47.99 | 2303.10 | 1.54 |
| 2870 | 8,236,900 | 104530 | 48.15 | 2318.50 | 1.64 |
| 2880 | 8,294,400 | 104170 | 48.32 | 2334.90 | 1.64 |
| 2890 | 8,352,100 | 103810 | 48.49 | 2351.30 | 1.50 |
| 2900 | 8,410,000 | 103450 | 48.66 | 2366.30 | 1.80 |
| 2910 | 8,468,100 | 103090 | 48.83 | 2384.30 | 1.47 |
| 2920 | 8,526,400 | 102740 | 48.99 | 2399.00 | 1.77 |
| 2930 | 8,584,900 | 102390 | 49.16 | 2416.70 | 1.69 |
| 2940 | 8,643,600 | 102040 | 49.33 | 2433.60 | 1.67 |
| 2950 | 8,702,500 | 101700 | 49.50 | 2450.30 | 1.58 |
| 2960 | 8,761,600 | 101350 | 49.66 | 2466.10 | 1.69 |
| 2970 | 8,820,900 | 101010 | 49.83 | 2483.00 | 1.70 |
| 2980 | 8,880,400 | 100660 | 50.00 | 2500.00 | 1.71 |
| 2990 | 8,940,100 | 100320 | 50.17 | 2517.00 | 1.61 |
| 3000 | 9,000,000 | 100000 | 50.33 | 2533.20 | 1.69 |
| 3025 | 9,150,625 | 99170 | 50.75 | 2575.60 | 1.71 |
| 3050 | 9,302,500 | 98560 | 51.17 | 2618.40 | 1.72 |
| 3075 | 9,455,625 | 97560 | 51.59 | 2661.50 | 1.74 |
| 3100 | 9,610,000 | 96770 | 52.01 | 2705.10 | 1.75 |

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## No. 24 Wavemeter Tables

| λ | $\lambda^2$ | n | O or $\sqrt{L.K.}$ | L.K. | D. |
|---|---|---|---|---|---|
| 3125 | 9,765,625 | 96000 | 52.43 | 2748.90 | 1.76 |
| 3150 | 9,922,500 | 95230 | 52.85 | 2793.10 | 1.78 |
| 3175 | 10,080,625 | 94490 | 53.27 | 2837.80 | 1.79 |
| 3200 | 10,240,000 | 93750 | 53.69 | 2882.70 | 1.80 |
| 3225 | 10,400,625 | 93020 | 54.11 | 2927.90 | 1.83 |
| 3250 | 10,562,500 | 92310 | 54.53 | 2973.70 | 1.83 |
| 3275 | 10,725,625 | 91600 | 54.95 | 3019.60 | 1.84 |
| 3300 | 10,890,000 | 90910 | 55.37 | 3065.80 | 1.87 |
| 3325 | 11,055,625 | 90220 | 55.79 | 3112.60 | 1.87 |
| 3350 | 11,222,500 | 89550 | 56.21 | 3159.50 | 1.90 |
| 3375 | 11,280,625 | 88890 | 56.63 | 3207.10 | 1.90 |
| 3400 | 11,560,000 | 88230 | 57.05 | 3254.80 | 1.86 |
| 3425 | 11,730,625 | 87590 | 57.46 | 3301.60 | 1.93 |
| 3450 | 11,902,500 | 86960 | 57.88 | 3350.00 | 1.95 |
| 3475 | 12,075,625 | 86330 | 58.30 | 3398.90 | 1.96 |
| 3500 | 12,250,000 | 85720 | 58.72 | 3448.00 | 1.98 |
| 3525 | 12,425,625 | 85100 | 59.14 | 3497.50 | 1.99 |
| 3550 | 12,602,500 | 84510 | 59.56 | 3547.40 | 2.01 |
| 3575 | 12,780,625 | 89310 | 59.98 | 3597.70 | 2.01 |
| 3600 | 12,960,000 | 83330 | 60.40 | 3648.10 | 2.03 |
| 3625 | 13,140,625 | 82750 | 60.82 | 3699.00 | 2.04 |
| 3650 | 13,322,500 | 82190 | 61.24 | 3750.20 | 2.07 |
| 3675 | 13,505,625 | 81630 | 61.66 | 3802.00 | 2.07 |
| 3700 | 13,690,000 | 81090 | 62.08 | 3853.80 | 2.09 |
| 3725 | 13,875,625 | 80540 | 62.50 | 3906.20 | 2.10 |
| 3750 | 14,062,500 | 80000 | 62.92 | 3958.80 | 2.12 |
| 3775 | 14,250,625 | 79470 | 63.34 | 4012.00 | 2.16 |
| 3800 | 14,440,000 | 78950 | 63.76 | 4065.00 | 2.16 |
| 3825 | 14,630,625 | 78430 | 64.18 | 4119.00 | 2.16 |
| 3850 | 14,822,500 | 77920 | 64.60 | 4173.00 | 2.20 |
| 3875 | 15,015,625 | 77420 | 65.02 | 4228.00 | 2.12 |
| 3900 | 15,210,000 | 76930 | 65.43 | 4281.00 | 2.20 |
| 3925 | 15,405,625 | 76440 | 65.85 | 4336.00 | 2.24 |
| 3950 | 15,602,500 | 75950 | 66.27 | 4392.00 | 2.24 |
| 3975 | 15,800,625 | 75470 | 66.69 | 4448.00 | 2.24 |
| 4000 | 16,000,000 | 75000 | 67.11 | 4504.00 | 2.28 |
| 4025 | 16,200,625 | 74540 | 67.53 | 4561.00 | 2.24 |
| 4050 | 16,402,500 | 74080 | 67.95 | 4617.00 | 2.32 |
| 4075 | 16,605,625 | 73620 | 68.37 | 4675.00 | 2.28 |
| 4100 | 16,810,000 | 73170 | 68.79 | 4732.00 | 2.32 |

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## No. 24 WAVEMETER TABLES

| λ | $\lambda^2$ | n | O or $\sqrt{L.K.}$ | L.K. | D. |
|---|---|---|---|---|---|
| 4125 | 17,015,625 | 72730 | 69.21 | 4790.00 | 2.32 |
| 4150 | 17,222,500 | 72290 | 69.63 | 4848.00 | 2.32 |
| 4175 | 17,430,625 | 71850 | 70.05 | 4907.00 | 2.36 |
| 4200 | 17,640,000 | 71430 | 70.47 | 4966.00 | 2.40 |
| 4225 | 17,850,625 | 71010 | 70.89 | 5026.00 | 2.36 |
| 4250 | 18,062,500 | 70590 | 71.31 | 5085.00 | 2.40 |
| 4275 | 18,275,625 | 70180 | 71.73 | 5145.00 | 2.44 |
| 4300 | 18,490,000 | 69770 | 72.15 | 5206.00 | 2.40 |
| 4325 | 18,705,625 | 69370 | 72.57 | 5266.00 | 2.48 |
| 4350 | 18,922.500 | 68970 | 72.99 | 5328.00 | 2.40 |
| 4375 | 19,140,625 | 68580 | 73.40 | 5388.00 | 2.52 |
| 4400 | 19,360,000 | 68190 | 73.83 | 5451.00 | 2.40 |
| 4425 | 19,580,625 | 67800 | 74.24 | 5511.00 | 2.52 |
| 4450 | 19,802,500 | 67420 | 74.66 | 5574.00 | 2.52 |
| 4475 | 20,025,625 | 67040 | 75.08 | 5637.00 | 2.52 |
| 4500 | 20,250,000 | 66670 | 75.50 | 5700.00 | 2.56 |
| 4525 | 20,475,625 | 66300 | 75.92 | 5764.00 | 2.52 |
| 4550 | 20,702,500 | 65940 | 76.34 | 5827.00 | 2.60 |
| 4575 | 20,930,625 | 65580 | 76.76 | 5892.00 | 2.60 |
| 4600 | 21,160,000 | 65220 | 77.18 | 5957.00 | 2.52 |
| 4625 | 21,390,625 | 64870 | 77.60 | 6020.00 | 2.68 |
| 4650 | 21,622,500 | 64520 | 78.02 | 6087.00 | 2.64 |
| 4675 | 21.855,625 | 64170 | 78.44 | 6153.00 | 2.64 |
| 4700 | 22,090,000 | 63830 | 78.86 | 6219.00 | 2.64 |
| 4725 | 22,325,625 | 62490 | 79.28 | 6285.00 | 2.68 |
| 4750 | 22,562,500 | 63160 | 79.70 | 6352.00 | 2.68 |
| 4775 | 22,800,625 | 62830 | 80.12 | 6419.00 | 2.64 |
| 4800 | 23,040,000 | 62500 | 80.53 | 6485.00 | 2.72 |
| 4825 | 23,280,625 | 62180 | 80.95 | 6553.00 | 2.72 |
| 4850 | 23,522,500 | 61860 | 81.37 | 6621.00 | 2.76 |
| 4875 | 23,765,625 | 61540 | 81.79 | 6690.00 | 2.76 |
| 4900 | 24,010,000 | 61230 | 82.21 | 6759.00 | 2.76 |
| 4925 | 24,255,625 | 60910 | 82.63 | 6828.00 | 2.76 |
| 4950 | 24,502,500 | 60610 | 83.05 | 6897.00 | 2.80 |
| 4975 | 24.750,625 | 60300 | 83.47 | 6967.00 | 2.84 |
| 5000 | 25,000,000 | 60000 | 83.89 | 7038.00 | |

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# Queries Answered

**Answers will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all letters and only one side of the paper written on; where diagrams are necessary they must be on a separate sheet and drawn with India ink. Not more than five questions of an individual can be answered. To receive attention these rules must be rigidly observed.**

**Positively no Questions Answered by Mail.**

W. R. B., Skagway, Alaska:

The majority of your queries are answered in the book "How to Conduct a Radio Club" on sale by the Marconi Publishing Corporation. This volume can be obtained by enrolling as a charter member of the National Amateur Wireless Association. The crystalline detector shown in your diagram is improperly connected to the circuits of the wave-meter. It cannot be placed in series with the elements of the radio frequency circuits because its resistance is too great to permit the free flow of electrical oscillations. It should be connected in series with the head telephones and both connected shunt to the variable condenser of the wave-meter.

The wave-length of a distant transmitting station can be determined at the receiving station in the following manner: The receiving apparatus is adjusted to the maximum strength of signals, making sure that the open and closed oscillatory circuits are in resonance. The wave-meter coil is then set in inductive relation to the earth lead of the receiving aerial and set into excitation by means of a battery and buzzer. The battery and buzzer are connected in series and the two remaining terminals in shunt to the variable condenser of the wave-meter. Connected in this manner, the wave-meter becomes a miniature transmitter, emitting waves of feeble damping. The variable element of the wave-meter is then altered until the maximum strength of signals is obtained upon the receiving apparatus. At this point the wave-meter and the receiving apparatus are in exact resonance. The wave-length of the wave-meter being known, the wave-length of the receiving apparatus must be of identical value.

It is impossible to estimate the wave-length of a wave-meter at various values of condenser capacity unless we know the inductance of the coil with which it is to be employed. If at a certain wave-length the capacity of the condenser is .001 microfarad and it is increased to .004 microfarad, the wave-length of the complete circuit will be increased by the square root of four, or exactly doubled. If the condenser capacity is increased to .005 then the wave-length is increased by the square root of five.

If the wave-length is known at the beginning and at the end of the condenser scale, the intermediate wave-lengths can be obtained if the condenser posesesses a straight line law of capacity, i. e., if the increment of capacity corresponds directly with the increase of degrees on the condenser scale. The average variable condenser is not constructed in this way, making it difficult to calculate intermediate values of wave-lengths. If means are available for determining the capacity of the variable condenser, the intermediate values of a wave-length can be approximated.

* * *

J. W. H., Hyde Park, N. Y., writes that recently he increased the power of his transmitting set from ¼ k.w. to 1 k.w. with the result that he is not able to cover the distance that he could previously. He then describes the set in detail; it is apparently well designed and should fulfill its purpose. The natural wave-length of the aerial cited is in the vicinity of 260 meters and therefore above the government restrictions.

He says that the hot wire ammeter reads 3 2-5 amperes with fairly loose coupling. With this value of current in the antenna circuit he should be able to cover forty miles without difficulty. Just why he is able to cover less distance with this apparatus we cannot advise, but perhaps there has been some misunderstanding regarding the current flowing in the antenna system with the previous apparatus. We were not given any data on this point. Perhaps there is leakage at the insulators. It may be tested by connecting the spark gap of the transmitting set directly in series with the antenna system and then connecting the terminals of the spark gap to the secondary winding of the high potential transformer. If there is no discharge at the gap with an exceedingly small distance between the discharge electrodes it is a positive indication that the antenna insulators leak. The earth plate described is apparently well placed, but the actual dimensions are not given. It may be of zinc or copper and there should be at least 250 square feet of surface enclosed in moist earth. There is a possibility that the receiving stations in the vicinity of J. W. H. are not attuned to the wave-length of the new set and consequently the signals are not received. Beyond this we cannot give advice.

* * *

I. M. H., Riverdale-on-Hudson, N. Y., has experienced a difficulty which many amateurs encounter in changing from a crystalline detector to one of the vacuum valve type. He says that he is able to receive the signals from Arlington considerably louder with an ordinary galena detector than with a three-


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element vacuum valve. However, he hears the nearby stations much louder on the vacuum valve than on the crystalline detector, and requests an explanation. The difficulty may be due to two causes: the vacuum valve may not be sensitive or the receiving tuner may be designed improperly for use with it. For adjustment to a given wave-length the vacuum valve detectors require a secondary winding with a condenser in shunt of a very small value of capacity, not more than .0001 microfarad. The average amateur tuner employs a much larger capacity for a given wave-length and in consequence loud signals are not obtained with the vacuum valve. The secondary winding of the receiving tuner should be reconstructed of No. 32 wire, sufficient turns being added so that a wave-length of 2,500 meters can be obtained with an exceedingly small value of capacity in shunt to the secondary winding. Then it will be found that the signals from Arlington will be much louder on the vacuum valve than with the ordinary galena detector. The fact that nearby stations are heard very loudly proves the correctness of our assertions because the stations in the vicinity of New York City operate on lesser wave-lengths than those of Arlington when sending the time signals.

* * *

G. S. G., Paterson, N. J., says that with an aerial 1,300 feet in length he is enabled to read the signals from the Sayville station, which employs undamped oscillations, on a crystalline detector. With an aerial 350 feet in length the signals from this station can be heard faintly; but with a short aerial, one 80 feet in length, the signals disappear. After carefully noting the accompanying sketch showing the location of the aerial, the design of the apparatus, etc., it is evident that the phenomenon observed is undoubtedly that described in the article, "How to Conduct a Radio Club," which appeared in the October, 1915, issue of THE WIRELESS AGE.. With a certain degree of coupling between the primary and secondary winding of the receiving tuner waves of two frequencies are set up in the associated circuits, resulting in the production of beats within the limits of audibility.

The Tuckerton station, which he also heard, employs the Poulsen arc transmitter during certain schedules. It has been found possible to receive these arc signals on ordinary crystalline detectors at a distance of from seventy to 100 miles without special design of the receiving circuit. This phenomenon is generally due to inequalities in the arc gap itself which has a slight damping effect, making the signals audible on the ordinary receiving equipment.

* * *

K. B. W., Cairo, Ill., sends a sketch of a vertical aerial which apparently he has designed to operate at a wave-length of 200 meters. He wishes to know the natural wave-length which, after calculation, we find to be 120 meters. It may be increased to 165 meters if the flat top portion, which is now 22 feet in length is increased to, say, 50 feet in length. This aerial with the apparatus described in his second query should make an efficient 200-meter set suitable for his purposes. With a 1 k.w. Thordarson high potential transformer the range of the station should be about twenty miles this depending, of course, upon the type of receiving apparatus in use at the receiving station.

* * *

J. L. A., Houston, Tex.:

Your six-wire aerial, 109 feet in length with an average height of 55 feet, has a natural wave-length of about 350 meters. It is rather long to operate efficiently at a wave-length of 200 meters. The insertion of a short wave condenser in series will reduce the natural period to about 180 meters which may be raised to 200 meters when the secondary winding of the oscillation transformer is connected in series. Four plates of glass, 8 by 8 inches, having an average thickness of, say ⅛ of an inch, covered with tin-foil, 6 inches by 6 inches on both sides, connected in series and then in series with the antenna system, will reduce the wave-length to about this value. For efficiency at a wave-length of 200 meters, we should prefer to decrease the length of the aerial rather than insert a short wave condenser in series. Then the flat top portion need not be more than 60 feet in length.

A high potential condenser suitable for the 1 k.w. Thordarson transformer, having a potential of 20,000 volts, may consist of twenty-four plates of glass, 14 by 14 inches, covered with tin-foil, 12 by 12 inches. Divide them into two banks of twelve plates, connected in parallel, then connect the two banks in series. The resultant capacity will be about .01 microfarad, as you desire. The average thickness of the glass should be about ⅛ of an inch. With a transmitting set of this type, all circuits properly proportioned and in resonance, you should be able to cover a distance of thirty miles.

Past issues of THE WIRELESS AGE have contained a number of diagrams applicable to the receiving apparatus you describe. We see no use for the two fixed condensers. One of them can be connected as shown on Page 743 of the July, 1915, issue of THE WIRELESS AGE. In that diagram the condenser, $C_1$, which is connected in series with the antenna, can in your case be connected in shunt to the used turns of the primary winding of the receiving tuner. In the event that you do not have a potentiometer and battery, you may connect the head telephones, PH, in shunt to the condenser, $C_2$.

We do not recommend the use of a 4,000-meter receiving tuner for the reception of amateur signals. Although this apparatus is fitted with dead-end switches, the average switch of this type merely disconnects the unused from the used turns and does not entirely eliminate the effect. With the values of inductance necessary for a wave-length of 200 meters, the unused portions of this tuner represent a considerable value of inductance and distributed capacity and therefore absorb considerable energy unless completely moved from inductive relation to the used turns of the cir-

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cuit. In the September, 1915, issue of THE WIRELESS AGE a receiving equipment suited strictly to the reception of 200-meter signals is fully described.

* * *

W. L., Horseheads, N. Y.:

The aerial described in your communication has a natural wave-length of about 277 meters and a capacity of .0004 microfarad. With the receiving tuner described, the entire system should be adjustable to a wave-length of 3,500 meters, depending, of course, upon the size of the condenser connected in shunt to the secondary winding. The second described aerial, having a length of 80 feet and a height of 40 feet, has a natural wave-length of about 220 meters.

It is not necessary for a condenser suitable for a 1-inch spark coil to consist of more than a single plate of glass, 8 by 8 inches, covered with foil, 6 by 6 inches. An oscillation transformer, with seven turns probably will be sufficient to place the condenser circuit in resonance with the antenna system. If possible obtain access to a wave-meter and have these circuits accurately calibrated. If your station is located outside the zone of commercial interference, the government authorities will probably allow a license for a plain aerial connection, i. e., the spark gap connected in series with the antenna system. We believe this method will give better results than can be obtained by the use of a condenser and an oscillation transformer.

* * *

R. J. F., Southampton, N. Y., inquires:

Ques.—(1) Please advise how you would guy a mast which has a total height of 85 feet. The lower 50 feet of this mast are of wind-mill tower construction and the remaining 35 feet a piece of 3-inch gas pipe which extends up through the middle of the tower.

Ans.—(1) Although this wind-mill tower is self-supporting and will of itself stand considerable strain, we are inclined to believe that four guy wires composed of No. 8 or No. 6 iron wire, attached to the mast about 8 feet from the top and securely fastened in ground anchors placed at a distance of 50 to 60 feet from the base, will afford a satisfactory support. The sketch accompanying your inquiry indicates that you intend to use two masts with a flat top aerial. It might be desirable to extend an extra guy wire from the top mast near to the point of attachment of the flat top aerial, to an extra anchor, to remove the side strain imposed by the aerial. Insulation of the guy wires with large porcelain knobs such as are employed in telegraph and telephone work also might be desirable.

Ques.—(2) Why cannot I hear the Sayville radio station? Before this station was taken over by the government authorities, its signals could be easily read every evening.

Ans.—(2) The Sayville station formerly employed spark apparatus, but now uses an undamped oscillation transmitter exclusively. You require a special receiving set to receive this energy.

Ques.—(3) How many volts are required to operate a ½ k.w. induction coil and how far may I expect to send under fair atmospheric conditions?

Ans.—(3) The ordinary ½ k.w. induction coil is intended to operate at a primary potential of about thirty volts, if employed in connection with a magnetic interrupter. Fitted to a condenser of correct capacity and an oscillation transformer of the proper dimensions, the entire set to be operated at a wave-length of 200 meters, you should be able to cover a distance of from ten to twenty miles, the distance depending upon the type of receiving apparatus used at the distant receiving station.

* * *

G. D. C., Bessemer, Ala., inquires:

Ques.—(1) Please advise through the columns of your magazine how I can shut out the induction from passing street cars. My station is situated close to the tracks and every time a car passes I find it impossible to receive signals. Is there any piece of equipment which I can purchase to eliminate this difficulty?

Ans.—(1) It is difficult to eliminate the inductive noises caused by sparking at the trolley wheel or at the commutators of the motor. Often the effect can be reduced by the use of an inductively-coupled receiving tuner employing the lowest value of coupling possible during the reception of signals from a given station. We fear that you will have to allow conditions to remain as they are.

We cannot calculate the wave-length of an irregular aerial of the design described.

* * *

H. T. C., Owensboro, Ky., inquires:

Ques.—(1) What is meant by a one to one transformer as an amplifier in connection with the vacuum valve? How can an induction coil secondary be used for this puprose?

Ans.—(1) A one to one transformer has the same number of turns in the secondary winding as in the primary, or at least the secondary is constructed to give the same value of potential applied to the primary winding. In the case of an auto transformer the term refers to one where the primary and secondary circuits include the same number of turns. The secondary winding of an induction coil may be employed for this purpose because it happens to have about the correct values of inductance, i. e., energy-storing ability required for use with the vacuum valve detector. This transformer acts as a temporary storage of energy for the current in the local circuit of the first valve from which it is transferred to the filament and grid of the second valve.

* * *

D. C., Sioux City, Iowa, inquires:

Ques.—(1) Can three wires in an aerial 150 feet in length be connected up so that one wire may be used for transmitting, although the three are connected together for purposes of receiving?

Ans.—(1) Certainly. The high potential end of the wires must be left open and the necessary switches fitted at the station to bring about the desired connections. When the single wire is used for transmitting the two remaining wires should be disconnected from

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the earth. Please take into consideration the fact that the addition of two wires to a single wire aerial does not greatly increase the natural wave-length of the system.

Ans.—(2) A two-wire aerial, 150 feet in length having an average height of 55 feet with the wires spaced 3 feet apart, has a natural wave-length of about 375 meters. Should the wires be spaced to the distance suggested in your third query the receiving range would not be increased noticeably.

The receiving tuner described in your fourth query is adjustable to wave-lengths of 3,500 meters, provided the seventeen-plate variable condenser described is connected in shunt to the secondary winding.

A government station is located at Fort Leavenworth, Kas. The call letters are WUD and the wave-length 1,800 meters. This station is under the control of the United States army.

* * *

G. R. C., Edgewood Park, Pa., inquires:

Ques.—(1) I have a four-strand aerial, 25 feet in height and 50 feet in length, with a spacing of 2 feet between the wires. What is the wave-length?

Ans.—(1)The natural wave-length of this aerial is about 125 meters.

Ques.—(2) Would I secure better results if I had a two-wire aerial, each wire being 100 feet in length?

Ans.—(2) The aerial described in your first query is more desirable for the reception of amateur signals at a wave-length of 200 meters, but for the reception of energy from higher power stations using wave-lengths in excess of 600 meters we should prefer a two-wire aerial, 100 feet in length.

Ans—(4) The average one-inch spark coil will allow communication to a distance of about five miles.

The three-element vacuum valve detectors cannot be purchased independently of the complete equipment.

* * *

S. M. C., Kenilworth, Ill., inquires:

Ques.—(1) Which is the more sensitive, a receiving set with a tikker and crystal in series, or a crystalline detector system with the connections as shown on page 53 of the October issue of THE WIRELESS AGE?

Ans.—(1) For the reception of undamped oscillations the best results are probably obtained with the tikker system. A crystal rectifier is not necessary with the tikker in series, but generally it has the effect of smoothing out the tone or note.

Ques.—(2) Is the lead from the detector (page 53) connected to a multi-point switch or is it connected at a fixed point on the coil, L-1?

Ans.—(2) It is preferably a variable tap-off connection. It makes no difference whether the operation is performed by a multi-point switch or by a sliding contact.

Ans.—(3) An aerial 70 feet in length by 30 feet in height is rather small to be boosted to a wave-length of 12,000 meters. A loading coil, 24 inches in length by 5 inches in diameter, wound closely with No. 20 or 22 wire, will raise the aerial system close to a wave-length of this value.

There will appear in an early issue of THE WIRELESS AGE an article on the Poulsen tikker with accompanying circuits, giving the information you desire.

A receiving tuner having a 10,000 meter secondary winding is described in the book "How to Conduct a Radio Club," published by the Marconi Publishing Corporation. Each charter member of the National Amateur Wireless Association will receive a copy of this volume as a part of his equipment.

* * *

A. E., Chicago:

Adding turns in either the primary or secondary winding of an oscillation transformer has the effect of increasing the length of the wave. If the circuits are in resonance and the number of turns are changed in one of the circuits, they will not be in resonance and there will be little transfer of energy.

Your aerial, 40 feet in height by 50 feet in length, consisting of four wires, has a natural wave-length of about 160 meters. With the oscillation transformer described, the emitted wave will be about 200 meters.

* * *

J. E., Belmont, Mass.:

The receiving apparatus described in your first query is adjustable to a wave-length of about 4,000 meters, provided the secondary winding is shunted by a variable condenser of, say, .0005 microfarad capacity. With the receiving aerial described you should be able to receive at least 1,000 miles during the nighttime and from 200 to 300 miles during the day. The average one-inch spark coil cannot be operated on a step-down alternating current transformer. You would find the results rather unsatisfactory. A one-inch spark coil connected to a quenched gap of small dimensions should transmit to a distance of from five to seven miles.

* * *

E. W. E., Red Bluff, Cal.:

Ques.—(1) Which is to be preferred, an aerial composed of four wires, 160 feet in length, 90 feet in height at one end and 60 feet in height at the other, or an aerial of similar length, 70 feet in height at both ends

Ans.—(1) If the height of 90 feet is at the high potential end of the antenna system, we should prefer this aerial; however, there will probably be little difference between the two types.

Ques.—(2) Is it possible that the lead-in wires from an antenna may be too large? What size lead-ins should be used, where the transmitting set is of low power? What should be the size of the ground wire on a two-inch coil transmitting set?

Ans.—(2) The lead-in wires should have a degree of conductivity equal to that of all wires in the antenna system. It is the general practice to bring the wires of the aerial direct to the secondary winding of the oscillation transformer. If necessary the lead-ins may be bunched from the flat top part of the aerial to the apparatus. The earth wire of a

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two-inch coil transmitting set should be made of No. 4 stranded copper wire or, of a piece of two-inch copper ribbon.

Ques.—(3) To what extent do trees affect the sending and receiving range? If my aerial was 200 feet away and fifty feet above large oaks, would the range in either sending or receiving be affected?

Ans.—(3) During the period of vegetation, when the trees are filed with sap, considerable energy is absorbed from a passing electromagnetic wave. If the trees are located at a distance from either the transmitting or receiving station, the absorption is not so intense. We believe that the oaks referred to will affect but slightly both the transmission and reception of signals, but the actual amount of absorption can be determined only by experiment.

Correct diagrams for an inductively-coupled receiving tuner, with associated appliances, have appeared in several of the preceding issues of THE WIRELESS AGE. Note the diagram of connections on pabe 743 of the July, 1915, issue of THE WIRELESS AGE. Duplicate it as closely as possible and you will have an efficient circuit.

The aerial described in your fourth query has a natural wave-length of about 410 meters.

* * *

J. R. S., Washington, D. C.:

We prefer wire larger than the ordinary bell wire for the lead-in of a transmitting or receiving aerial. No advantage is derived in spacing the wires of an aerial. as shown in your drawing. If the distance between wires is at least two feet, better results cannot be expected by increased spacing.

* * *

W. L. E., Peekskill, N. Y.:

The wave-length of the aerial described in your communication is about 252 meters. It will be increased to at least 300 meters by the addition of the secondary winding of the oscillation transformer in series. With the condenser described, the closed circuit seems to be considerably out of resonance with the antenna system. We do not believ that the wavelength of the spark gap circuit is more than 180 meters.

The station at Sayville employs an undamped generator of about 100 k.w. capacity. The power at Glace Bay is variable from 70 to 200 kilowatts. The transmitting station at New Brunswick employs 300 kilowatts of energy. The Belmar receiving station is not open for inspection.

We do not understand why you require a choke coil in series with a one-inch spark coil. We cannot see the value of it unless the spark coil is to be operated on alternating current of. say, 110 volts and the choke coil is employed to cut down the input.

* * *

P. S. E., Biddeford, Me.:

Your aerial, 50 feet in height and 68 feet in length, has a natural wave-length of about 219 meters. The constants of an inductively-coupled receiving tuner, for the reception of Arlington time signals, appear on page 73 of the October, 1915, issue of THE WIRELESS AGE, under C. H. S.'s inquiry.

* * *

F. V. H., Brooklyn, N. Y., inquires:

Ques.—(1) Please give the wave-length of an aerial 200 feet in length, 80 feet in height, comprising 4 wires with a lead-in 100 feet in length.

Ans.—(1) The natural wave-length of this antenna is about 490 meters.

Ques.—(2) Please give the wave-length of an aerial 350 feet in length by 80 feet in height, comprising 2 wires and a 5-foot spreader with a 2-wire lead-in 50 feet in length.

Ans.—(2) The natural wave-length of this antenna is about 640 meters.

Ques.—(3) Is it possible to receive on a tin roof 30 by 100 feet?

Ans.—(3) Tin roofs have often been employed as receiving aerials and if placed on wooden buildings will give as efficient results as properly constructed aerials.

Ans.—(4) Your question regarding the dimensions of a loading coil and the probable wave-length to be expected is not clear, and we do not understand the construction of the loading coil described. Regarding the use of loading coils in the primary and secondary windings: It is preferable to insert a loading coil in the secondary circuit as well as in the primary circuit in order to effect conditions of resonance. The mere insertion of two loading coils in series with the antenna circuit would simply raise the wave-length of that circuit and unless corresponding adjustment were made in the secondary circuit a loud response would not be obtained.

* * *

J. E. L., Marquette, Mich., writes:

Ques.—(1) What is the wave-length of an aerial comprising 2 wires, 110 feet in length by 45 feet in height at one end and 75 feet at the other, with a 50-foot lead-in to the middle? The aerial is supported on 3½-foot spreaders.

Ans.—(1) The natural wave-length of this antenna is about 315 meters.

Ques.—(2) Can No. 34 or No. 36 enameled copper wire be used successfully for the secondaries of receiving transformers and variable loading coils?

Ans.—(2) When employing detectors of the vacuum valve type No. 34 or No. 36 wire in the secondary winding is entirely feasible, but for loading coils in the primary circuit somewhat coarser wire should be used. For example: The antenna circuit loading coil should be made of, say, No. 20 wire. Of course, if the secondary winding is of No. 36, the loading coil to be used in connection with it may be of the same size.

* * *

E. H., Oakland, Cal.:

We believe your receiving troubles are outside of the water tank to which your aerial is attached. Some local condition or error in

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your receiving apparatus, prevents you from obtaining satisfactory results.

It is somewhat difficult to eliminate induction from near-by high power or high tension lines. The least trouble in this respect is experienced when the receiving aerial is swung at right angles to the power wire. A balancing-out aerial, which will aid in eliminating this effect, is described in the book, "How to Conduct a Radio Club," published by the Marconi Publishing Corporation. This volume is a part of the equipment of each charter member of the National Amateur Wireless Association.

* * *

P. J., Minneapolis, Minn.:

If your receiving apparatus already responds to the signals from the Arlington station, you should have no difficulty during the nighttime in receiving signals from commercial stations located in the Great Lakes district. We are unable to state just why you do not hear the signals from the station in Minnesota. It operates at wave-lengths of 300 and 600 meters and should be heard during the nighttime throughout the favorable months of the year. Perhaps the design of your receiving apparatus is such that it is more suited to the reception of the longer wave-lengths than the shorter wave-lengths, such as are employed by ship and shore stations, namely, 600 meters. There are few spark stations to-day operating at wave-lengths of 2,500 meters. Many naval stations now employ arc transmitters for the production of undamped oscillations which are not audible on the ordinary receiving apparatus. The Arlington station employs more power than any of the remaining spark stations in the United States, with the exception of the Marconi Trans-Atlantic and Trans-Pacific stations. The Marconi station at Bolinas, Cal., employs about 300 kilowatts at wave-lengths varying from 6,000 to 12,000 meters.

* * *

C. W. J., Norwalk, Ct.:

An efficient circuit for use with the vacuum valve detector is fully described in the article, "How to Conduct a Radio Club," published in the October, 1915, issue of THE WIRELESS AGE. Details of another circuit suitable for the Poulsen tikker also are published.

Your two-wire aerial, 300 feet in length by 55 feet in height, has a natural wave-length of about 546 meters.

The receiving tuner described in your third query is adjustable to wave-lengths near to 4,000 meters when the condenser of .001 microfarad is connected in shunt with the secondary winding. Whether the primary winding is suited to this secondary winding depends upon the length of the aerial with which it is to be employed. If it is to be used with the aerial described in your second query, the design is quite correct for the range of wave-lengths obtainable in the secondary winding.

Some difficulty is experienced in the warping of hard rubber. Why not use bakelite or some of the more modern insulating materials now employed for such work?

B. S. H., Louisville, Ky.:

A secondary winding suitable to the primary winding which you already have may be made on an insulating form, 5¼ inches in diameter by 6 inches in length, wound closely with No. 32 wire. The points of this winding may be divided between the taps of a twelve-point switch. If we knew the dimensions of the aerial with which this receiving tuner was to be employed, we could give more specific data.

* * *

O. H., Canton, O.:

The natural wave-length of your aerial is about 295 meters. With the proposed apparatus it should be adjustable to wave-lengths up to 3,500 or 4,000 meters.

Information concerning the construction of a wave-meter is given in the book, "How to Conduct a Radio Club," published by the Marconi Publishing Corporation.

The Sayville station is still in communication with Nauen and operates at a wave-length of about 9,400 meters. The power employed is 100 kilowatts and the system is of the Joly type.

* * *

P. W. H., Fredericktown, O.:

The average amateur three-inch spark coil transmitting set does not cover more than twelve miles. You should therefore be quite satisfied with the results obtained. A glass plate condenser suitable for this coil may consist of four plates, 8 by 8 inches, covered with tin-foil 6 by 6 inches. These plates should be connected in parallel.

NAF is the naval station at Newport, R. I.

* * *

E. C. R., Washington, D. C., inquires:

Ques.—(1) Please state the relative advantages of the open and closed core transformers for amateur work. I note that while the majority of commercial transformers are of the open core type, the new Marconi sets, as described in a recent number of THE WIRELESS AGE, are fitted with a transformer of the closed core construction.

Ans.—(1) The advantage of the open core transformer lies in the fact that it posseses a certain amount of magnetic leakage and therefore the inductance of the primary circuit remains fairly constant under conditions of a variable load at the secondary winding. This is of distinct value, because when the spark gap is dicharging, the secondary winding of the transformer is practically short-circuited and should the entire field of the secondary winding react directly upon that of the primary winding, the effective self-inductance of the latter would be decreased with a corresponding increase of current flow.

The closed core transformer fitted with a magnetic leakage gap has operating characteristics somewhat similar to those of the open core transformers. In the Marconi sets the same effect is produced but in a different manner. In that particular type of equipment the design of the generator is such that there will not be an abnormal rise of current in the primary winding when the secondary winding of the transformer is short-circuited.

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With proper design, the open and closed core transformers may be made equally efficient, but generally the open core transformer requires more material and has larger over-all dimensions than the closed core for a given number of kilowatts.

* * *

T. B., Mestyte, Tex., inquires:

Ques.—(1) What is the wave-length of my aerial which has an over-all length of 80 feet and height of 33 feet?

Ans.—(1) Assuming it to be a four-wire aerial with the average spacing, the natural wave-length is about 205 meters.

Ques.—(2) A has a sending set with a range of 2,000 miles; B lives 1,000 miles from A. What size aerial is required at B's station to receive signals from A? What instrument would be required with the aerial described in my first query?

Ans.—(2) We require more data to give a concise answer to this query. What type of transmitting apparatus is used at A.'s station? Does it employ damped or undamped oscillations? What is the wave-length? If the station is fitted with an undamped oscillation generator, a receiving apparatus fitted with a tikker or one of the special vacuum valve detector circuits, must be employed. A receiving circuit suitable for both damped and undamped oscillations is described in United States patent No. 1,113,149; somewhat similar circuits are described in the book, "How to Conduct a Radio Club," published by the Marconi Publishing Corporation. Apparatus of this type is applicable to the aerial described in your first query, as well as the putative aerial referred to in your second query. For reception of wave-lengths between 5,000 and 10,000 meters, we prefer an aerial at least 700 to 800 feet in length. For wave-lengths below 5,000 meters, the aerial need not be more than 300 feet in length. Vacuum valve circuits are also described in the "Proceedings of the Institute of Radio Engineers" for September, 1915.

* * *

H. F. H., Watertown, N. Y.:

Ques.—(1) My station is fitted with an aerial 80 feet in length, 50 feet in height at one end and 25 feet in height at the other. The apparatus consists of a loading coil, loose coupler, fixed and variable condensers and a galena detector; why will not a 2,000 ohm head set give as loud signals when receiving from long distances, as a head set having two eighty-ohm receivers. The apparatus is connected up as shown in the enclosed diagram. The inductively coupled receiving transformer is wound with No. 20 wire in the primary and No. 26 in the secondary.

Ans.—(1) The accompanying diagram is quite correct, but we believe increased strength of signals would be obtained if the head telephones were connected in shunt to the fixed condenser of the local detector circuit rather than in shunt to the detector. Perhaps the 2,000-ohm head telephone set is out of order. The magnets may be weak, or the diaphragm too close or too far from the core of the magnet. With crystalline detectors it is generally found that a 2,000-ohm head set will give better signals than one of lower resistance but it is not alone the resistance which determines its sensibility; the over-all construction should be taken into account.

Ques.—(2) Will the vacuum valve detector pick up the undamped waves emitted from the Poulsen arc transmitter without the use of a tikker?

Ans.—(2) Yes. See the answer to T. B.'s inquiry in this issue. Special circuits are required.

Ques.—(3) Please give a formula for calculating the size of a secondary condenser for transmitting apparatus when the required capacity is known.

Ans.—(3) The following formula is applicable:

$$C = \frac{K\ A\ 2248}{T \times 10^{10}}$$

Where A = the area of the dielectric in use. in square inches,
T = the thickness of the dielectric in inches,
K = the dielectric constant of the insulating medium,
T = the capacity in microfarads.

The value of K generally ranges from 6 to 9.

Ques.—(4) At present I use an electrolytic interrupter, Wehnhelt type, connected to a 110-volt A. C., sixty-cycle lighting circuit. I also employ stationary spark gap, coil and condensers. The spark secured is intense but of variable pitch. How can I raise the pitch of this spark without employing a rotary gap?

Ans.—(4) An improvement might be effected if a chemical rectifier were connected in series with the electrolytic interrupter, the alternating current impulses being changed to direct current before being broken up by the interrupter. If you had available 110-volt D. C., the spark note, of course, would be very high.

* * *

J. W. Crawfordsville, Ind.:

The aerial described in your first query has a natural wave-length of about 290 meters. You should be able to receive the Arlington time signals during the 10 P. M. eastern standard time schedule.

The telephonic conversation at Arlington was carried on at a wave-length of between 6,000 and 7,000 meters. You require apparatus such as described in the book, "How to Conduct a Radio Club," to receive these signals at a considerable distance.

* * *

N. J. G., Toledo, Ohio.:

The wave-length of your 80-foot aerial is about 230 meters.

There are no relaying devices for radio stations in use.

A one-inch spark coil can be heard to a distance of five miles if the receiving station is fitted with sensitive apparatus. Two one-pint Leyden jars have a value of capacity suitable for the average one-inch spark coil, provided they are connected in series.

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The call letters of the Illinois Watch Company's station are 9ZS. The wave-lengths employed are 6,000 and 2,000 meters.

* * *

E. W. D., Jersey City, N. J., writes:

Referring to the question asked by H. G. C., of Atlantic City, which appeared on page 138 of the November issue of THE WIRELESS AGE, I wish to state that if he would lower his voltage slightly, he would overcome the arcing of the points on the vibrator, for the reason that an arc cannot be readily formed at voltages below thirty. This will allow the vibrator to work satisfactorily without the use of a condenser of large capacity about the interrupter.

* * *

W. O., Covington, La.:

The time signals are sent out daily from the New Orleans Naval Station at a wave-length of 1,000 meters. This station is also fitted with a 30 k.w. arc set for the production of undamped oscillations.

The receiving aerial you describe has a natural wave-length of about 375 meters. There is no distinct advantage in employing four wires in receiving; equally good results generally are obtained with a two-wire aerial. The receiving set you describe should allow the reception of New Orleans time signals and if they are not actually heard there is some defect in the apparatus.

* * *

O. R. T., Stoughton, Wis., writes that his transmitting apparatus emits an exceedingly broad wave, causing considerable interference. He describes his equipment, which is fairly well designed and, provided there are no high resistance joints in the circuits of radio frequency, should function efficiently and in compliance with the United States restrictions as regards a sharp or pure wave.

Calculation of the wave-lengths of the antenna system reveals that the natural wave-length is about 259 meters which is, of course, considerably raised when the secondary winding of the oscillation transformer is connected in series. If it is planned to have this station operated on a wave-length of 200 meters the dimension of the aerial should be considerably reduced. Perhaps the insertion of a short wave condenser in series with the antenna system will permit a fair degree of efficiency at a wave-length of 200 meters. The condenser described in the communication has a capacity of about .01 microfarad which is correct for 200-meter work provided the connections to the closed oscillatory circuit are extremely short.

O. R. T. has experienced conditions found at the average radio station fitted with a plain spark discharger that, namely, when a sharp or pure wave is obtained the current reading in the antenna circuit is somewhat less than can be obtained by a closer degree of coupling. This does not necessarily mean, however, that the station will be less efficient because under conditions of tight coupling two wave-lengths are radiated, while with the lesser coupling the energy radiated is confined practically to a single wave-length which may have the same value of current, or nearly the same value of current, as either of the single wave-lengths when two frequencies are emitted. We suggest that O. R. T. carefully inspect the earth connection. It may be that it does not possess sufficient conductivity or capacity to properly take care of the energy of the antenna system.

Ques.—(2) Which type of aerial is preferable for general amateur use—the "T" or the inverted "L" type?

Ans.—(2) For a given wave-length an aerial of the "T" type will have greater dimensions than those of the inverted "L." That is to say, it will have a greater value of capacity, but decreased value of inductance. The inverted "L" type is generally employed for amateur work, although good results will be obtained with either.

* * *

D. G. C., Grosse Pointe, Mich., inquires:

Ques.—(1) I have an aerial 120 feet in length, 45 feet in height with a ground and a lead-in connection totalling about 50 feet. What is the natural wave-length of this aerial?

Ans.—(1) Approximately 315 meters.

Ques.—(2) How could the aerial referred to be reduced, by condensers or otherwise, to a wave-length of about 185 meters?

Ans.—(2) To be reduced to this value a series condenser of exceedingly small value of capacity would be required in series with the antenna system. From a practical standpoint we consider the dimensions of the aerial too large for 200-meter work. It is suggested that the aerial be reduced so that the flat top portion is not more than 50 or 60 feet in length, thereby obviating the necessity of a short wave condenser.

You have been misinformed concerning the vacuum valve detector. It is just as applicable to short distance work as to long distance communication. Sometimes the most sensitive adjustment cannot be maintained when a transmitting station of high power operation is nearby, but under these conditions it only becomes necessary to adjust the detector to a less sensitive state.

The most sensitive crystalline detectors are the crystalloi, cerusite, galena, silicon, perikon, etc. We suggest that you purchase samples of each kind and make your own tests, thereby satisfying yourself concerning their stability and sensibility.

* * *

J. S., Pittsburgh, Pa., inquires:

Ques.—(1) Can two 1-inch spark coils be connected in parallel to a six-volt forty-ampere hour storage battery? And when so connected can the secondaries of each be joined together in some manner so that the high potential current will jump a gap of 2 inches?

Ans.—(1) For effectiveness the primary windings should be connected in series, the interruptor of one coil screwed up tight and that of the second coil employed to interrupt the current for both coils. Similarly the secondary windings should be connected in series, taking care to connect them so that the sec-

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ondary voltages will not oppose each other. While the potential of the system will be increased as a whole, you need not expect a 2-inch spark unless similar values of current flow through both primary windings, as would exist in the case of a single primary winding.

* * *

A. J. M., Westfield, N. Y.:

Your first, second and third queries regarding induction motors are beyond the scope of this department. We suggest that you communicate with the makers of the device or with some publication that makes a practice of handling such queries.

Ques.—(4) Why does the spark on my rotary gap which is connected to a sixty-cycle source of supply tend to become a long stringy spark, no matter at what speed the disc is run or how many points there are on the disc?

Ans.—(4) Lacking a detailed description of the complete transmitting apparatus it is somewhat difficult to answer this question. It would seem, however, that the stationary electrodes are spaced too far from the rotary electrodes. The best results are obtained with rotary spark gaps when the stationary electrodes are placed exceedingly close to the movable electrodes, thereby keeping the spark gap length at a minimum.

Ques.—(5) May the Brown telephonic relay be used successfully to amplify radio signals?

Ans.—(5) Yes, very good results indeed have been obtained with it.

* * *

G. F., Davenport, Ia.:

The 3-wire aerial of the "T" type, 100 feet in length, with an 80-foot lead-in has a natural wave-length of about 188 meters. When the secondary winding of the oscillation transformer is connected in series undoubtedly the wave-length is raised above 200 meters. The wave-length of this aerial can be reduced by inserting two condenser plates connected in series and then placed in series with the antenna system. These plates should be 8 by 8 inches, covered with tin-foil 6 by 6 inches. A wave-meter should then be employed and sufficient turns of inductance added at the secondary winding of the oscillation transformer until the antenna system has a natural wave-length of 200 meters. The use of a series condenser at any wave-length is not advised for transmitting purposes, if it can be avoided. As you say, it might be preferable to erect a separate aerial for transmitting purposes and a long aerial for receiving from stations using longer wave-lengths.

The capacity of your transmitting condenser is quite correct for a wave-length of 200 meters, being approximately .008 microfarad.

* * *

J. F. W., Roanoke, Va.:

Ans.—(1) Your query regarding the Darien station, Isthmus of Panama, is fully answered in the "Queries Answered" department of the August, 1915, issue of THE WIRELESS AGE.

Ques.—(2) What does the abbreviation "QSZ" mean, as used by the Arlington station?

Ans.—(2) This abbreviation means, "Repeat each word twice."

Ques.—(3) Does the use of wireless telegraphy by railroads on trains affect the telegraph lines and the train despatching telephones?

Ans.—(3) No; not if properly installed.

Ques.—(4) Will a silicon detector work properly with a 1-step amplifier?

Ans.—(4) Yes, provided it is properly connected up. (See January, 1914, issue of THE WIRELESS AGE).

* * *

E. W. H., Peekskill, N. Y., inquires:

Ques.—(1) Why is it that when my apparatus is switched to a sending position I can hear a few of the nearby stations, including the Brooklyn Navy Yard and the station at Bush Terminals? I am sure that no wires of the transmitting apparatus cross the circuits of the receiving apparatus. I use the following sending apparatus: Namely, a ½-inch spark coil, an oscillation transformer, straight spark gap, glass plate condenser. Can you explain this phenomenon?

Ans.—(1) When your receiving aerial is switched into the sending position it is, of course, directly connected to earth, and consequently oscillations of various stations will flow through it. Some portion of your receiving tuner circuits must be in inductive relation to the open oscillatory circuit of your transmitting set; hence you receive the signals. The editor of this department has frequently received signals at a distance of 180 miles in daylight without an aerial connection to the receiving apparatus.

Ans.—(2) The receiving set you describe should have a range of about 500 miles.

* * *

T. L., North Adams, Mass., has an antenna 57 feet in length, 60 feet in height at one end and 50 feet at the other. It is composed of three strands of No. 14 wire, the lead-in being 30 feet in length and the ground lead 20 feet in length. The wires are spaced 1½ feet apart. He asks for the wave-length of the antenna.

Ans.—The natural wave-length of this antenna is about 210 meters.

It is very difficult to give the range of a receiving set having the apparatus described, but offhand we should say that you should be able to receive at a distance of 200 miles in daylight from commercial stations.

Regarding the effect of a loading coil of 5,000 meters: We advise that this will be of no value whatsoever unless the remaining circuits of the receiving tuner are attuned to this wave-length. Furthermore, we know of no stations operating at a wave-length of 5,000 meters in this vicinity.

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# Announcement and Application Blank

# National Amateur Wireless Association

PRESIDENT, Guglielmo Marconi.

NATIONAL ADVISORY BOARD OF VICE PRESIDENTS

Professor Alfred N. Goldsmith
College of the City of New York, Institute of Radio Engineers.

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President, American Radio Relay League.

Major William H. Elliott,
Adjutant General Junior American Guard.

E. E. Bucher, Instructing Engineer, Marconi Wireless Telegraph Company.

ADMINISTRATIVE OFFICERS:

ACTING PRESIDENT,
J. Andrew White,
Editor, THE WIRELESS AGE.

MANAGING SECRETARY,
Clayton E. Clayton,
450 4th Avenue, New York.

A national organization of wireless amateurs was announced in the October number of THE WIRELESS AGE. Further details of the organization are given in an address made by J. Andrew White, which was published in the November WIRELESS AGE. Reprint copies sent upon request. It is of vast importance to the wireless amateurs of America.

## ENROLLMENT OF CHARTER MEMBERS.

During the next three months, charter members of the National Amateur Wireless Association will be enrolled on special arrangement. Charter members will receive the following:

## CHARTER MEMBERS' EQUIPMENT.

1st. **CERTIFICATE OF MEMBERSHIP.**

The handsomely steel-engraved Certificate, with shadow background half-tone, is sealed and signed by Officers, with the endorsement of Senatore Marconi, as President. Every member will want to frame and place it alongside of his Government License certificate, two documents establishing status as wireless amateurs.

2nd. **AERIAL PENNANT.**

The 36 inch aerial pennant, painted in four colors on scarlet felt, will stand long service at your aerial mast head. Every member will be proud of the National Insignia flying from his aerial.

3rd. **MEMBERSHIP PIN.**

The National Amateur Wireless Association Pin in gold and enamel is the National emblem of the Association. The design shown on this page can but faintly describe its handsome appearance in three colors and gold. The pin has a special patented hub and shank which permits it being securely fastened on the coat lapel or on the vest without turning upside down.

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**4th. HOW TO CONDUCT A RADIO CLUB.**

This splendid book, which has been months in preparation and incorporates portions of articles running under the same title in THE WIRELESS AGE, is re-written to cover every new development, and with a large proportion of new matter. It is the foundation stone of the National Amateur Wireless Association activities. Price of this book 50c.

**5th. LIST OF RADIO STATIONS OF THE WORLD.**

Revised Edition just published. See advertisement. Regular 50c edition.

**6th. HOW TO PASS U. S. GOVERNMENT WIRELESS LICENSE EXAMINATIONS.**

Regular 50c edition of this popular book. Members who already have a copy, see concessions below.

**7th. MONTHLY BULLETIN SERVICE.**

It is intended to make the monthly bulletin service for members of the National Amateur Wireless Association one of the most important features of the Association. This bulletin is to be used in connection with "List of Radio Stations of the World" described above. It will carry all additions (both amateur and commercial) to "List of Radio Stations of the U. S.", issued by the Bureau of Navigation, U. S. Department of Commerce, and secured for members at 15c a copy. It is issued only once a year. The Association Bulletin will keep both lists up to date for you month by month, and in addition, will carry other special and invaluable Association features not obtainable elsewhere.

**8th. ONE YEAR'S SUBSCRIPTION TO THE WIRELESS AGE.**

THE WIRELESS AGE becomes the Official Organ of the National Amateur Wireless Association and will contain full reports of wireless amateur activities, both national and local. It is planned to give published recognition to individual amateur achievement.

## CONCESSIONS:

Those who, *during the past six months,* have become subscribers to THE WIRELESS AGE, or have renewed their subscription, or have purchased any portion of the Charter Membership Equipment, may consider such payment as partial payment of Charter Membership Application as given below. If you have paid for a subscription to THE WIRELESS AGE which includes books which are not a part of the Membership Equipment, then you may credit $1.25 of the remittance as partial payment on the Charter Membership. For example, you may have remitted $2.25 for the combination offer of the 1915 Year Book with one year's subscription to THE WIRELESS AGE. In this combination, the price of both the book and the subscription was reduced, to make the special offer; therefore, you may be credited only with that part of the payment which went to the magazine—that is, $1.25. Coupon subscribers receive no credit for trial orders. Subscribers to THE WIRELESS AGE who *began or renewed more than six months ago,* will secure through full Charter Membership fee a renewal for another year; and their subscriptions will be extended for one year from the time the present subscription expires.

## ANNUAL DUES FOLLOWING FIRST YEAR.

The annual dues are to be not more than $2.00, after the first year. For this, all members are to receive:

1st. The Monthly Bulletin Service.

2nd. THE WIRELESS AGE for one year.

3rd. Special 50c. Instruction Books at 30% off list price.

4th. 10% discount on any book on wireless published, and other features to be announced later.

## THREE MONTHS ONLY OPEN TO CHARTER MEMBERS.

Charter Members will be accepted for three months only on special arrangement. After three months the Initiation Fee of $1.00 will be required.

(*Application blank on next page*)

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**SPECIAL NOTICE REGARDING CORRESPONDENCE.**

As the National Amateur Wireless Association is in no sense a money making enterprise, and as the nominal dues will cover a very small amount of handling expense, it is desired that the correspondence be limited to only the most essential necessities. Read this announcement over again before asking questions. See if the answer is not already given.

Many general questions will be answered in the Service Bulletins; special matters pertaining to local questions should be handled through the Corresponding Secretary of Local Clubs and Associations.

**Clayton E. Clayton, Managing Secretary,**
**450 4th Ave., New York.**

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Checks and money orders should be made payable to: Natl. Amateur Wireless Assn.

**APPLICATION FOR MEMBERSHIP.**

CLAYTON E. CLAYTON, Managing Secretary,

NATIONAL AMATEUR WIRELESS ASSOCIATION, Date.....

450 4th Avenue, New York City.

As I desire to receive full recognition as an amateur wireless worker of the United States, I ask the privilege of enrollment as a Charter Member in the National Amateur Wireless Association and request that you send me the Charter Members' Equipment for which I enclose herewith remittance of $2.50.* (Option.)

I trust that you will act upon my application promptly and forward the equipment to me at the earliest possible date.

My qualifications for membership are given in blank spaces below.

Signature ..... Age.....

Street Address .....

Town and State.....

Please credit me with $..... paid for.....

* Option.

In the event that an applicant is unable to send the entire amount of the membership dues with this application, the figure $2.50 may be crossed out and $1.00 written in its place. This will be considered an agreement on the part of the applicant accepted for Membership that the balance of dues ($1.50) will be paid at the rate of 50c per month for the next three months, at which time pin, pennant and Certificate of Membership will be issued. The other equipment will be sent at once.

**FILL IN ANSWERS TO THESE QUESTIONS.**

1—Have you a Government License (give number.....) or do you purpose applying for one?.....

2—If you are under 21 years of age, give names of two adults for references as to character.

Reference.....

Reference.....

3—If you are a member of any Local, State or Interstate wireless club or association, give its name, and name of Secretary with address.

.....

4—Are you now a subscriber to THE WIRELESS AGE?.....

5—If you already have any books included in the equipment, state which ones.....

.....

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# National Amateur Wireless Association

A DIRECTING ORGANIZATION DEDICATED TO THE PROMOTION OF RADIO COMMUNICATION

CALL LETTERS 9PY
S. W. PIERSON
CARROLLTON, ILLINOIS

GUGLIELMO MARCONI, PRESIDENT

Reduced fac-simile of letter head.

## For Clubs and Members of National Amateur Wireless Association

The following list of items of optional equipment is listed at cost price in order to give members and clubs of the Association every material advantage in the way of a complete equipment that may be desired. Prices include transportation charges.

**LETTER HEADS AND ENVELOPES:**
100 National Association Letter heads with imprint of member at left hand side, as illustrated above 75c
Without member's imprint..... 35c
100 Envelopes with imprint..... 65c
*Special prices on 1000 Letter Heads to Clubs.*

**MESSAGE BLANKS:**
Pads of 50..... 10c

**STATION LOG BOOK:**
A record book in which to keep track of all your operations and communications, in paper..... 15c
in cloth ..... 30c

**RADIO STATIONS OF THE U. S.:**
Call list issued by the U. S. Department of Commerce, postpaid.. 18c

**PHOTOGRAPHS AND PICTURES:**
Photographs of important stations, such as Belmar, Arlington, Sayville, Honolulu, etc., 9" x 12", each ..... $1.00

Duotone picture of G. Marconi, with facsimile signature, suitable for framing ..... 25c

**SOLID GOLD BUTTONS,** 14 Karat N. A. W. A. emblem..... $1.75

**WIRELESS MAP OF THE WORLD** in colors ..... 50c

**YEAR BOOK OF WIRELESS TELEGRAPHY AND TELEPHONY,** published at $1.50, special to members and clubs ..... $1.10

**CLUB PENNANTS:** Made of first quality wool bunting, letters and emblem sewed on with cut outs in color and name of club added, prices on application.

Fac-simile of 36 inch Pennant.

**Send all orders to Clayton E. Clayton, Managing Secretary, National Amateur Wireless Association, 450 Fourth Ave., N. Y. City.**


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# THE WIRELESS AGE

Owing to the fact that certain statements and expressions of opinion from correspondents and others appearing in these columns from time to time may be found to be the subject of controversy in scientific circles and in the courts, either now or in the future, and to sometimes involve questions of priority of invention and the comparative merits of apparatus employed in wireless signaling, the owners and publishers of this magazine positively and emphatically disclaim any privity or responsibility for any statements of opinion or partisan expressions if such should at any time appear herein.

FEBRUARY, 1916

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# S O S--Thessaloniki

## An Elusive Vessel and the Far-Reaching Wireless

*Aristotelis Vranicas, first operator on the Thessaloniki*

**How the Art Was Employed to Keep Other Craft in Touch with a Ship That Was Saved, Lost, Found and Finally Abandoned. The Devotion to Duty of Three Marconi Operators in Time of Stress and the Rescue Which Followed Days of Hardship and Peril**

*Kimon Paleologos, second operator on the wrecked ship*

PICTURE a wave-battered, leaking ship tossed about in an ocean of heaving waters; on its decks a little band of men waiting for rescue ships to come in response to S O S calls; a fleet of vessels, guided by wireless messages from the hapless craft, searching the wide expanses of the sea to bring succor. This is the setting in which the story of the wreck of the Greek Line steamship Thessaloniki and the devotion to duty of Marconi Operators, Aristotelis Vranicas, Kimon Paleologos, and James Lambros is placed.

Vranicas, the chief operator; Paleologos, his assistant, and Lambros, who was voyaging from Greece to the United States to take up his duties as wireless man on another vessel, first had the distinction of summoning a rescue ship to the battered Greek craft in order to take off her passengers. Then the hawsers with which the Thessaloniki was being towed, parted and the vessel was again placed in peril. For three days the wireless man and the ship's officers and crew drifted about in mid-Atlantic, undergoing hardship and peril. Finally they were rescued by a vessel which had picked up the wireless appeals.

The Thessaloniki steamed away from Piraeus, the seaport of Athens, on October 29, with about 215 passengers, a crew of ninety and a mixed cargo. She touched at Calamata, Patras, Messina and Algiers, made her way through the Straits of Gibraltar and then laid her course for New York.

From the time she cleared Gibraltar the static had been heavy, indicating that stormy weather prevailed. She had engine trouble, too, and made slow progress, arriving at a point west of the Azores on December 21 at four o'clock in the afternoon.

Here begins the real story of the Thessaloniki's voyage, for she had poked her nose into a westerly gale and terrific seas which tossed her about as if she were a toy. The blow continued for twelve hours and at the end of that time the exhausted ship's officers and crew found that their struggle to keep the ship afloat was just beginning; into the engine and boiler rooms the water came in a steady flow—so rapidly, in fact, that it covered the flooring to a depth of several feet although the pumps were immediately placed in operation. The lifeboats, too, had been swept away and the seas threatened to accomplish further damage.

The plight of the vessel was so serious that on the following morning Vranicas sent an S O S, the appeal being picked up by the Italian steamship Stampalia. The latter vessel was informed that the Thessaloniki was leaking dangerously and was able to proceed only at the rate of



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about two miles an hour. Stirred into action by the tenor of this message, the commander of the Stampalia steamed toward the distressed vessel, arriving alongside about midnight.

He first made an attempt to communicate with those on the Greek steamship by means of signal lights and, this method having failed, the wireless was utilized. By this time the pumps on the Thessaloniki were being operated to good purpose and the commander of the Stampalia was so informed. The Stampalia stood by until eight o'clock the next morning, however. Then he was told that the boiler and engine rooms had been cleared of water and that the Greek ship would not require aid. At that time she was listing to port, but the gale had moderated, and the Stampalia steamed away.

For a time all went well with the Thessaloniki and she proceeded slowly on her voyage. But on December 26, the storm broke again, this time with redoubled fury. Great waves swept over her decks, carrying away the batteries and entering the wireless cabin. The wind blew terrifically also and the aerial, yielding to its force, fell to the deck with a crash. Vranicas, Paleologos and Lambros repaired the aerial, however, and placed it again in position. Power for the set was obtained from the ship's dynamo.

As the hours wore on conditions grew worse instead of better. The pumps went out of commisison and the ship's company with the aid of some of the passengers worked with buckets to bail the ship. The supply of drinking water ran low, too, consequent upon the delays in the voyage, and there was no more meat.

In this crisis wireless was again employed, appeals for aid being sent on December 28 to the steamship Florizel and to the United States revenue cutter Seneca. The Florizel replied that she was steaming to the aid of the disabled steamship with all possible haste and she arrived at six o'clock in the evening three days later. In the meantime, the steamship Patris, which had been informed by wireless of the Thessaloniki's distress, had answered that she was speeding to the rescue. She arrived about midnight. The storm was still raging, but the commander of the Thessaloniki, in view of the fact that the Patris was standing by, notified the Florizel that it would not be necessary for her to render aid.

The seas had subsided somewhat on New Year's morning and the passengers on the Thessaloniki were transferred to the Patris. A supply of fresh water was sent to the former vessel and preparations were made to tow the disabled ship to New York. The Seneca was nearing the scene about this time and she set word by wireless to that effect. On learning that the Patris had arrived, however, she put back to New York.

The Patris began the towing of the

*The operators on the Thessaloniki were aided in their work by James Lambros, who is shown in this photograph. Lambros was voyaging to New York to take up his duties as wireless operator on another vessel*

Thessaloniki to port later in the day. But she had not proceeded far when the hawsers broke. They were quickly repaired, however, and the voyage was resumed. Toward evening of the next day the vessels ran into a northeasterly gale and the hawsers again parted. Wireless messages were exchanged between the ships in efforts to locate each other, but the darkness and the storm interfered. So the Thessaloniki, once more at the mercy of the waves, drifted and rolled in the trough of the seas. A wireless message from the Patris said that she was attempting to return to her consort, and the men on the Thessaloniki watched and

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*The United States revenue cutter Seneca which twice responded to the Thessaloniki's S O S. The revenue cutter combed the waters of the Atlantic for many hours when the second appeal was flashed*

waited for hours, but she did not appear.

For three days the ship's company on the water-logged vessel faced a situation that seemed almost hopeless. The engines were out of commission and the engine and boiler rooms were awash. The dynamo still remained in operation, however, and the wireless set was consequently not deprived of power. And notwithstanding the fact that the wireless cabin was almost continuously battered by the waves which carried away the door and window of the room, flooded the compartment and thundered their menace at the Marconi men within, the operators unceasingly flashed their appeals for aid. Their calls were answered, ships were rushed to the scene and the waters were combed in an effort to find the sinking vessel, but the storm and the speed at which she was drifting seemed to be unsurmountable stumbling blocks.

The Seneca, with First Operator Brenner on board, was in the Brooklyn Navy Yard when she received the Greek ship's second calls for aid. The steamship United States and other vessels had also picked up the appeals and they sped into the storm to find her. Meanwhile, the ill-fated ship was drifting and tossing on the waste of waters; a few words, at intervals by wireless conveying the intelligence that she was still afloat.

The Thessaloniki's men, battling with the storm to keep the vessel from foundering, were handicapped by cold, fatigue and lack of sleep. The supply of water obtained from the Patris had run low and there was no food except bread. These conditions told severely upon everyone and Vranicas in addition suffered from a slight fever.

From time to time came reassuring messages from the vessels engaged in the search.

"Show as many lights as you can, we are doing our best," flashed the operator on the United States in response to the message, "Come quick," from the sinking ship, on the night of January 4.

Followed a period during which the Thessaloniki's officers and crew peered through the storm and darkness looking without success for a rocket shooting skyward or the lights of the rescue ship. Again resource was had to the wireless and the United States replied:

"Our captain says he hopes to find and save you all. Do not get nervous."

And so another day dawned with no rescue ship in sight. The seas were still running high and the ship was tossing and

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rolling more violently than ever. The men in the wireless room had picked up a message from the steamship Perugia to the effect that she was speeding toward the Greek ship as fast as the storm would permit, but it was late in the morning when those on the distressed vessel glimpsed a bit of smoke over the white crested waves. At length the funnels of a steamship came into view, then the outlines of her hull and after a time the

*Operator Alex Brenner, of the revenue cutter Seneca*

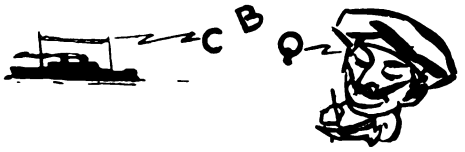
Perugia hove to within a short distance. One by one the Thessiloniki's weary company dropped into the rescuing vessel's small boats and clambered onto her decks. Then the Perugia pointed her bow toward New York. leaving in her wake the foundering vessel.

## ORDERING DINNER BY WIRELESS

Giving orders by wireless for dinner is the latest development in the management of modern restaurants. An eating house in New York City has announced that passengers on steamships bound for that city can make arrangements by marconigram to have the table set before they arrive.

For instance, if Tourist Purdy, of Milwaukee, feels a yearning for corn beef and cabbage as the vessel on which he is voyaging approaches the Atlantic coast, he can send a wireless message directly from the steamship to the station on the roof of the restaurant. In order to facilitate the ordering, a list of abbreviations has been prepared, C. B. and Q, being used to designate corn beef and cabbage. If Purdy's taste runs to ham and eggs he will only find it necessary to use the letters, H. E., and the employment of the abbreviation, M. P., will be sufficient to start the chef preparing mince pie.

If his mouth waters for beefsteak and onions, the craving can be satisfied by using the abbreviation, B. and O. The idea that Purdy is fond of omelette can be conveyed by O. N. S., while the chef will busy himself with cooking stewed chicken and mushrooms on the receipt of W. D. The abbreviation B. B. stands for plum pie and C. P. A. for cafe parfait. The danger signal of the abbreviated code is W. A. S., which means, We are starving and is answered by H. E. (ham and eggs), repeated three times in succession. W. A. B. (meaning we are broke) is the signal of distress and is answered by an emphatic K. A. (keep away).

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# THE DISTINGUISHED PRESIDENT OF THE N. A. W. A.

GUGLIELMO MARCONI, PRESIDENT OF THE NATIONAL AMATEUR WIRELESS ASSOCIATION, is known to every man, woman and child throughout the universe as the inventor of wireless telegraphy and the greatest living benefactor of the human race. As the discoverer of the art of radio communication he takes his place as the first amateur in the world and, as the supreme authority in the field, stands as the natural leader of experimenters. Marconi's sympathy with the ambitions of budding scientists is attested by the fact that he himself made his first wireless set when a boy. Since then he has received the degrees D. Sc., from Oxford University, LL.D., from Glasgow. He has been made an Italian Senator and serves that country both as a naval commander and army officer. His acceptance of the presidency of the amateur organization marks the first time he has consented to hold office of similar nature



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# THE ADMINISTRATIVE OFFICERS

J. ANDREW WHITE, ACTING PRESIDENT, is universally acknowledged as the best infomed individual in the United States on the needs of amateur wireless workers. As editor of the first magazine published on the subject of radio communication, he has been since 1911 the distributor of information which has placed the American amateur in the front rank of the experimental field. In the creation and development of THE WIRELESS AGE he has been the inspiration of countless articles which have revolutionized communication methods and stand for the remarkable progress made in the past few years. He is the author of more than three hundred unsigned articles.

CLAYTON E. CLAYTON, MANAGING SECRETARY, has long been prominently identified with various educational movements and has aided thousands of young men to work their way through college. Ten years of practical experience in handling organizations of nation-wide activity, combined with knowledge of every section of the country gained at first hand, has equipped him for the task of disposing of the countless details which arise in administering to thousands of members scattered all over the continent. Mr. Clayton is also in charge of a bureau established to provide for appropriate and timely information on all important subjects.

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# NOTED PROFESSORS WHO ARE VICE PRESIDENTS

ARTHUR E. KENNELLY, VICE-PRESIDENT, is also president of the Institute of Radio Engineers and one of the best known scientists in the country. He is professor of electrical engineering at Harvard and holds two degrees from that university, Dr. Sc. and A.M.; he is a past-president of the American Institute of Electrical Engineers and as principal electrical assistant to Edison secured a world-wide reputation as an electrical investigator. An elementary volume on wireless, of which he is the author, is considered the standard work in its class.

CHARLES R. CROSS, VICE-PRESIDENT, is Thayer professor of physics and Director of the Rogers Laboratory at Massachusetts Institute of Technology, familiarly known as "Boston Tech" and ranking as a leader among the American seats of technical learning. His connection with wireless dates back to 1903, when he was selected as expert to testify in a legal action to uphold one of Marconi's early tuning patents, and may therefore be considered a pioneer in the study of the art. Prof. Cross is Fellow, American Academy of Arts and Sciences.



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# NOTED PROFESSORS WHO ARE VICE PRESIDENTS

ALFRED N. GOLDSMITH, VICE-PRESIDENT, is considered one of the best informed wireless experts in the United States. He is assistant professor of physics, College of the City of New York, Director of its Radiotelegraphic and Radiotelephonic Laboratory and holds the degree, Ph. D. As editor of the Proceedings of the Institute of Radio Engineers, he is responsible for the accuracy in presentation of technical papers which literally monument progress in the engineering branches of the art. To Prof. Goldsmith's energy and tireless devotion to the subject may be attributed in large measure the standardizing of investigation in the field of radio communication.

SAMUEL SHELDON, VICE-PRESIDENT, has been since 1889 professor of physics and electrical engineering at the Brooklyn Polytechnic Institute, N. Y. He has three degrees; Ph. D., from Würzburg University; D. Sc., from University of Pennsylvania, and A. M. from Middlebury, Vt., where Prof. Sheldon was born. He is the author of several textbooks on electrical engineering and president of the Library Board of the American Institute of Electrical Engineers, which organization he has also served in the past as its president. He is known to be a strong advocate of the inclusion of wireless instruction in the curriculum of all technical schools and colleges.

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# REPRESENTATIVES OF SEA AND LAND FORCES

CAPTAIN W. H. G. BULLARD, VICE-PRESIDENT, needs no introduction to wireless men. As Superintendent of the United States Naval Radio Service he is the chief executive of the department which supervises the governmental operation of wireless stations on land and sea, the first man to be appointed to that high office. This distinguished officer is a graduate of Annapolis and served in the navy for twenty-six years before rising to his present rank of captain. In 1907 he organized the department of electrical engineering and became its first head. While in this office he prepared the well known "Hand Book for Naval Electricians."

MAJOR WILLIAM H. ELLIOTT, VICE-PRESIDENT, formerly of the 1st Battalion Signal Corps, has long been known as one of the most active militia men in New York serving in the early nineties as drillmaster in the American Guard and later enlisting in and becoming a commissioned officer in the famous 71st Regiment. As Adjutant General of the Junior American Guard he is now devoting his energies to the important work of preparing the youth of the nation to serve the country in event of war. He offers to all N. A. W. A. members an opportunity to secure military training and to perfect themselves as efficient signal officers.

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# INSTRUCTION AND ORGANIZATION COUNSELLORS

ELMER E. BUCHER, INSTRUCTING ENGINEER, holds the same position with the Marconi Wireless Telegraph Company, training ship operators for service at sea. Mr. Bucher is credited with having constructed one of the earliest amateur plants in the country, a home-made station completed in 1901. Two years later he entered the commercial ranks and made the first United States long distance records overland. He was also among the first to install equipment on ships of the government revenue cutter service. After supervising the construction of several important commercial land stations he was assigned to instruction of operators, and has continued in that capacity since 1909.

HIRAM PERCY MAXIM, VICE-PRESIDENT, is the inventor of the Maxim Silencer for fire-arms and a prominent figure in amateur wireless telegraphy, through his position as Chairman of the American Radio Relay League, organized to establish a working chain of amateur stations throughout the United States. Mr. Maxim is an ardent supporter of all movements tending toward betterment of working conditions in the amateur field and has given active co-operation in establishing and maintaining local clubs for the development of members. To make his recommendations practicable he has installed and regularly operates a 1 k. w. set at his home, and is constantly experimenting with new devices and arrangements of apparatus.


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# Marconi's Visualization of Future Warfare

## Victory Will be Determined by the Bayonet and the Knife. His Impressions After Service at the Front

"IF we could find apparatus capable of producing electric waves powerful enough to produce explosions at a distance we then undoubtedly would see extraordinary sights such as modern inventors tell us we are destined to see—the blowing up of battleships at sea, the causing of shells to explode inside the guns and even in the soldiers' belts. That would bring us back to hand to hand fighting."

This was the statement recently made to the correspondent of a Paris newspaper by Guglielmo Marconi, second lieutenant in the Italian Army, who returned to Rome in December last after an absence of five months in England and at the front in France and Flanders. At the last, he said, hand to hand fighting will prevail with what the Italians designate as the "white arm." In land battles victory will be won with cold steel, the bayonet and the knife, and the fate of empires will hinge upon the prowess of the soldier in the ranks.

Mr. Marconi said that science undoubtedly was one of the principal factors in the successes obtained by the Germans. There was genuine surprise among the forces of the entente countries at the scientific preparation in the armies of the Kaiser, but in that respect the Allies are now equally strong.

"In aviation," he said, "contrary to what had been expected, the Germans also showed their preparations had been on a most efficient scale. They had very fine machines and exceedingly clever pilots. By prompt and energetic action the Allies soon caught up to them and now surpass them in this respect, a fact which is proved by recent bombardments of German towns.

"Another surprise with regard to air machines was the fact that very large air craft equipped with wireless telegraph apparatus of a new kind, were put in the field at the beginning of the war. The French, however, captured a few of these machines; the secret became common property and the benefit which the Germans expected from their invention in this regard was frustrated.

"In the matter of wireless stations also the Germans are inferior to the Allies. The most powerful station of all is one now established in England. Every day the Allies are adding little scientific improvements of a most useful kind and in a great number for wireless purposes. I cannot speak of them, because it is necessary to keep our secrets. I may say, however, that the Germans, who have remarkably well-equipped workshops and laboratories, are in a position to replace all their damaged parts, but the Allies, daily making new scientific progress, already are on a par with their adversaries and soon will have left them behind."

Mr. Marconi believes that in the war of the future science will figure far more prominently than it has in the present European conflict, and fantastic man-killing machines of extraordinary



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size will be employed to reap death and destruction.

He told another newspaper correspondent that the year just ended was full of bitter disappointments for the Allies. Germany made great headway, although not altogether in the direction in which she wanted to go. But she is in possession of Poland and she still holds Belgium, while Serbia is crushed.

"If Germany could make peace," declared the inventor, "I believe she would be willing to give up Belgium, but she would insist upon holding part, if not all of Poland, and upon getting back Alsace-Lorraine from France and her South African colonies from England. Such a peace never would be accepted by the Allies.

"To make victory sure the Quadruple Alliance must move in precise accord until the end, each making a heroic sacrifice of men and financial sinews. Political upsets only retard the concerted action so supremely necessary. There must be no more mistakes of diplomacy.

"Italy is throwing all her energy into the war. Already she has 3,000,000 men in arms. She will hold Albania and help Saloniki if need be. But I don't believe Italian aid is needed for Saloniki, for the British and French seem capable of holding their own. I don't believe the Germans will get into Greece.

"So the war will have to go on and I fail to see any prospect of the end of it by next winter. From observations I've made everywhere, I'm sure the conflict will be carried on, regrettable as it is, beyond next Christmas."

Mr. Marconi delivered his first speech in the Italian Senate on December 15, his utterances winning for him the congratulations of the other senators. The Italian press also published laudatory comments on his speech and called attention to its practicability and vigor.

A noteworthy feature of his speech was his recommendation that all ships of the mercantile marine of the allied governments be requisitioned and their use fairly divided among the entente countries.

"With reference to the economic operation which, in this war of attrition, must represent a most powerful weapon in favor of the nations of the entente," he said, "serious questions must be taken into consideration which demand careful study on the part of the allied governments.

"I do not believe that the fall in the exchange value of the Italian lira, as compared to the pound sterling, which has attained an enormously high rate of exchange, is entirely justified either by the conditions of our gold reserve or by the balance of trade between Italy and other countries. Ocean freight rates, based on London quotations, which have risen to an extent which does not seem to be justified, raise to a very high figure in Italy the cost of staples indispensable to the nation. The regulation of exchange values and of freight rates is a difficult problem, but one susceptible of an equitable solution if the allied governments will face it with energy and in a spirit of loyal co-operation.

"As to the desired regulation of ocean freight rates, a means of sure effect would result if all the allied governments should requisition the ships of the mercantile marine at equitable and uniform rates for the carriage of the more essential staples, the rates to be decided on by agreement between all the governments concerned."

Mr. Marconi declared that it was the duty of all the Allies to aid one another. He also pointed out the necessity for applying conscription not only to fill the ranks of the army, but also to keep the soldiers in the field supplied with necessities.

"In every national war," he said, "there are two kinds of persons, those who think only of conquering and dying and those who think only of living and making a financial profit. This second category should be transformed into a second grand army, severely disciplined, for the development and production of all that the armies require for warfare and all that the nation itself needs.

"This second army ought to be inspired in all the countries of the Allies

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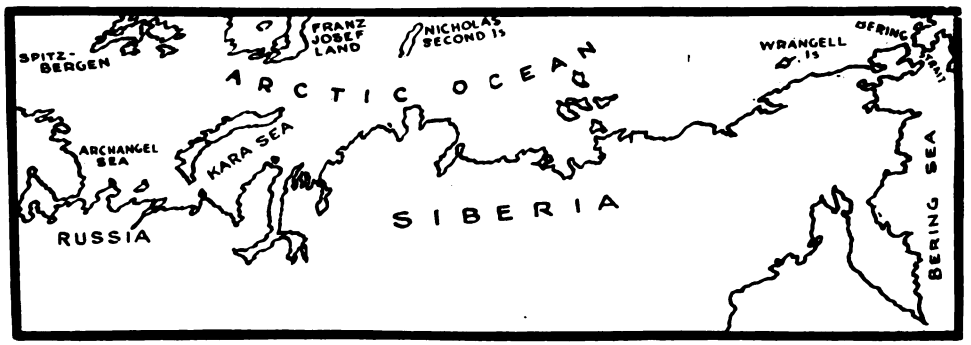
with exactly the same spirit of sacrifice as the army fighting in the field. The man who cannot offer his life to the nation can offer to it his labor and his money."

An interesting bit of gossip was put into circulation following Mr. Marconi's return to Italy. It is to the effect that he will be promoted to the rank of colonel in recognition of his services. He wore mufti instead of his uniform while in Italy.

# Wireless in the Northeast Passage




BEYOND the uttermost outpost of Siberia, between the bleak white plains that stretch southward to the Arctic Circle and the ice-pack grinding down from the Pole, lies a little gray steamer huddled close under the black cliffs of Cape Chelyuskin. Out of the twilight that precedes the six months of polar night comes the song of the spark—words of cheer and goodwill flash across the leagues of floe and frozen mountains and two hardy explorers, Captain Otto Sverdrup and Captain B. A. Vilkitski, have established communication.

Vilkitski, an officer in the Russian Navy, and the second man in 300 years to sail from Bering Sea to Archangel, Russia, through the Northeast Passage, left Vladivostock in July, 1914, in command of two small ice-breakers to explore the northern coast of Siberia and attempt the Northeast Passage. With the same vessels he had the year before discovered Nicholas II Land—a large rugged island lying between Cape Chelyuskin and Franz Joseph Land.

Although the two steamers were fortunate enough to round Cape Chelyuskin, they were caught by the pack on the western side and forced to seek shelter for the winter. Nevertheless, they had accomplished a notable feat, for the cape has always presented a most formidable obstacle to Arctic exploration. Dominated by high and forbidding mountain ranges pointing straight north, half way between the Circle and the Pole, this promontory has ever been one of the most difficult and perilous in the Arctic.

Meanwhile, Sverdrup, a veteran of Nansen's expedition, had been dispatched from Norway in search of Lieutenant Brussiloff, a lost explorer who then lay dead on the coast of Franz Joseph Land. Trapped, like Vilkitski, by the closing pack, he had prepared to winter in an inlet some eighty miles south of the Russian's refuge.

The wireless operator of the Vilkitski forces tapped out call after call in the hope that it might reach someone somewhere. Down the desolate coast swept the message and Sverdrup received the communication of his fellow-explorer. As a result the two captains, in spite of storm, cold, ice and darkness, joined forces.

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# Wireless Equipped Barges for the Mississippi

## Contract for Equipment of Thirty-Six Power Vessels With Marconi Apparatus Part of Revolutionary Plan for Inland Water Transportation

THAT navigation on an extensive scale will be restored to the Mississippi River this year, is indicated in the announcement that the Marconi Wireless Telegraph Company has completed with the Inland Navigation Company one of the largest contracts for wireless equipment and operation ever made. The contract is the largest known except for that by which the Marconi Company equipped the Standard Oil fleet.

The navigation company, a $9,000,000 corporation, is building thirty-six power barges varying in capacity from 1,600 to 5,000 tons, which will travel on regular schedules between Minnapolis and New Orleans, with stops at all important points between these two cities on the Mississippi River and its tributaries. The first barge is now nearing completion at the Howard Shipyards, Jeffersonville, Ind., and the company expects to have a number of the barges in actual service by next March.

This promised restoration of traffic on the Mississippi River on a large scale comes after years of agitation, in which business men of New Orleans, St. Louis and other cities have sought the realization of some such plan as that of the Inland Navigation Company. For a long time the efforts for this achievement were directed toward the deepening of the river by Federal appropriation, so that vessels of deep draught might go up as far as St. Louis, but Congress declined on several occasions to make the necessary appropriation. The necessity for deepening the channel of the river, it is said, has now been avoided by the plan of using barges that will draw only a few feet of water, and will therefore be able to navigate without danger or difficulty.

The idea of using wireless equipment is a striking feature of the plan; for never before has wireless been called into service on an extensive scale for inland navigation. Each of the barges will be equipped with 2 k.w., 500-cycle panel type Marconi quenched gap sets, which will give a continuous communication range of 400 miles or more. Marconi operators will be aboard the barges, and service will be supplied between the barges and between each barge and land station as at present in ocean navigation.

The wireless apparatus is expected to be of particular value in keeping shippers advised of market conditions and directing the transshipment of cargoes to take advantage of favorable developments. For example, if a shipper sends a cargo of wheat, or any others product, down stream consigned to New Orleans, and learns, after shipment, that his cargo can be more profitably disposed of at some other market, he will be able to communicate with the barge by wireless and direct a change in destination.

By the wireless also the operating officials of the navigation company will be able at all times to know the exact location of any barge. Through this knowledge they can keep shippers and receivers of freight informed of the time of delivery of any cargo. If, too, a barge runs aground at any point in the river, or suffers other mishap, a hurry call for assistance can be sent out without delay. The importance of this is evident when it is realized that accidents to barges are likely to occur in desolate regions at points miles distant from cities and towns.



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The proposal of the navigation company is to compete directly with the railroads. The idea of those financing the company is to facilitate the movement of the crops of the West and Middle West and of the cotton and other products of the South. Shipments of wheat, apples, etc., will be taken down the river for delivery to river ports or for reshipment at New Orleans to New York or through the Panama Canal to Pacific Coast ports. Cotton and other products will be carried upstream.

Not only will the freight rates be lower than those of the railroads, it is said, but the company promises to guarantee a speed in transportation unusual in inland water traffic. Each barge is to be equipped with four 80-horsepower engines working separate propellers. There will be an express and a slower service, the express barge being built to make eighteen miles an hour upstream and twenty-four miles an hour downstream. The slower barges will go eight miles an hour upstream and twelve miles an hour down.

## NEW OFFICERS OF THE INSTITUTE

At a meeting of the Institute of Radio Engineers held January 5, at Columbia University, Professor A. H. Taylor presented a paper on "Variations in Nocturnal Transmission," prepared in collaboration with A. S. Blatterman.

The following officers will be in charge of the Institute during 1916: president, Professor A. E. Kennelly; vice-president, John L. Hogan, Jr.; treasurer, Warren F.Hubley; secretary, David Sarnoff.

The list of managers follows: To serve until January 2, 1918, Louis W. Austin and John Hays Hammond, Jr.; to serve until January 3, 1917, Robert H. Marriott and Guy Hill; to serve until January 1, 1919, Edwin H. Armstrong and Captain W. H. G. Bullard; to serve until January 3, 1917, Lloyd Espenschied, John Stone Stone and Roy A. Weagant.

Professor Alfred N. Goldsmith was appointed editor of publications and Louis G. Pacent, advertising manager.

## HONOLULU-JAPAN SERVICE TO START SOON

The Japanese government has notified the Marconi Wireless Telegraph Company of America that the new wireless station at Funabashi, near Tokio, is completed and will soon be ready for transpacific communication. Experimental work between Honolulu and Funabashi is now going on and the reports indicate that the system is working in splendid fashion at both terminals, which are separated by a distance of 3,400 miles. The Funabashi station is equipped with Marconi apparatus, but is owned and operated by the Japanese government.

The exact date of the commercial opening of the service is yet to be announced, but for the fact that Japan is at war the service would probably already be in operation, it is understood.

## NESCO SUIT DISMISSED

Judge Mayer dismissed on January 7 the wireless patent infringement suit brought by Samuel M. Kintner and Halsey M. Barnett, receivers of the National Electric Signaling Company, against the Atlantic Communication Company, which operated the Sayville wireless station. It was complained that the defendant had infringed two claims of a patent granted in April, 1909, to Reginald A. Fessenden, and four claims of another patent of the same man which applied to the manufacture of wireless apparatus.

"The musical note" emitted in using the wireless was one of the points upon which it was claimed that the Fessenden patent had been violated, but Judge Mayer pointed out that he could not hold that Fessenden had been the original discoverer of its value. As he was working out his idea De Forest was actually operating commercial stations with it, and was working at the method in his own way.

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# The Missing Submarine

**By Giles Lebrun**

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**Of course the incidents dealt with in this stirring fiction story never occurred, probably never will. But that it is within the realm of possibility—particularly because of the development of submarines which will be revealed after the war is over—is one of the reasons why we print it. The story's author is a naval man and thoroughly informed as to the limitations of submersibles, also their possibilities. He has written this under an assumed name, as he expresses it, solely "for entertainment."**

LIEUTENANT COMMANDER BELDING, of the United States scout cruiser Vidette, attached to the North Atlantic fleet at maneuvers, received by wireless the command to report at the earliest possible moment on board the flagship Pennsylvania.

Though it was no part of the wireless operator's business, the man mentioned that he had heard the same urgent message addressed to the commanders of the two other scout cruisers off the New England coast, as well as to each of the dozen newest and swiftest destroyers.

"It probably means only a change in the plan of maneuvers," said Belding. "But the Pennsylvania's calling the ships from both sides."

"I noticed that," nodded Gregory. "Also that order came in the regular navy cipher, you see; not in the code for maneuvers."

"Something's happened, to call maneuvers off!" said Belding, and he set the engine-room dial for full speed ahead, as the quartermaster at the wheel, put the swift ship about in its course.

The commander, staying upon the bridge, watched with impatience the sea slipping past as his turbines rushed the sharp cruiser on. Streaks of smoke, staining the blue on both sides, soon told him that the other scout ships and destroyers were converging hastily toward the position of the flagship; the order evidently had impressed other commanders as urgent, immediate, an emergency.

Under the smoke streaks, now the long, lean lines of the fleet's flyers appeared; and ahead, as the goal of all, loomed up the leaden bulk of the battleships. Flags from the peak of the Pennsylvania painted in gaudy colors against the sky the confirmation of the wireless orders: "Comanders of scout cruisers and destroyers report aboard instantly."

The knife-prowed vessels cut in close and drew up, vibrating with engines reversed, a few lengths apart; as they stopped, a boat dropped from the davits of each, and they bobbed in a line beside the big battleship as the commanders of the auxiliary ships climbed aboard.

As Belding reached the flagship's deck, he saw from the demeanor of the enlisted men that something real, indeed, was in the wind. Secrecy was spelled in the glances of the lieutenants and captain of the flagship and most particularly in the admiral. Belding watched him closely as he welcomed the young commanders into his cabin and ordered the doors closed.

"Gentlemen, I have called you here for an extremely delicate duty—the destruction of a vessel of war of a power with whom we are at peace."

"Sir?" escaped from some one.

"You have all heard, I assume, of the loss last week of the French submers-



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ible Corday? Well, what do you—for instance—know of it, Mr. Belding?"

"It went out from Brest on Tuesday of last week, as I recollect, sir," Belding replied. "It was making maneuvers with a division of the French fleet. It went from the harbor and proceeded afloat for some time, and then ran submerged, as expected. Nothing was thought of its being missing till several hours passed, and it failed to rejoin the fleet. It had often run submerged for more than a day. It was not till Thursday, I believe——"

"Correct; that was eight days ago," the admiral confirmed. "Proceed, Mr. Belding."

"——that serious anxiety was felt. But then when it still failed to return to Brest and was not reported elsewhere, a search was instituted. That was rather useless, as, if the Corday went down, it might have disappeared anywhere within several thousand square miles at sea, as it had a submerged running radius of some hundreds of miles. Nothing was found of the Corday; and, after the time expired during which men aboard could have remained alive under water, she was announced as lost."

"For the sake of the public peace of mind, gentlemen, and at the behest of the English and American as well as the French transatlantic lines," said the admiral.

"The truth of the matter, as made known to our government by the French navy department to-day, is that the Corday never was lost."

"Not lost, sir!"

"For the benefit of the gentlemen who may not have kept informed on recent French submarine development, I may recall that the Corday was—or, rather, is—the latest of the French designs. She has a speed, when fully submerged, of some twenty knots, quite equal to that of most transatlantic liners. She carries oxygen and fuel which makes her capable of running submerged for some forty hours. Running on the surface or occasionally submerged, she could, of course, cross the Atlantic, and by this time probably has done so."

"Sir?"

"The French have information which makes it certain the Corday did not disappear by accident. After submerging off Brest, the crew mutinied, killed the officers, probably thrust their bodies—weighted—through the torpedo tubes, and brought the Corday out into the North Atlantic steamer lanes, where a conning tower of a submersible, running awash, was sighted by an English passenger vessel. The captain told the passengers that it was either one of ours or a British submarine maneuvering; but the submersible was running awash in order to put a wireless aerial above the water to inform Englishmen that it was the Corday and, on its return trip, would sink the liner unless the steamship line paid a certain demanded sum—some million francs—to a man who would identify himself at their offices to-day; also, two ships would be blown up if the man was afterward molested or attempt was made to follow him."

The lieutenants stared at their senior officer.

"Unquestionably this seems strange, gentlemen. However, you may estimate the opinion of the French government of the character of the men aboard the Corday. To-day the French guaranteed to the line the payment of the amount asked, and requested our navy department, together with the English, to co-operate in the search and capture or destruction of the Corday.

"Your instructions, therefore, are immediately to patrol North Atlantic steamer lanes to protect all ships. You will capture or destroy the Corday, when found, as dictated by circumstance, and so far as possible keep the cause of the patrol secret to prevent panic on the ships now at sea."

No sign of the Corday was reported by the captains of the crowded liners bound for Queenstown, Southampton, Cherbourg, Rotterdam, or the ships from those ports to New York.

This was the notice the captains posted on the bulletin board beside the saloons of the liners for the pasengers to read:

Maneuvers are going on.

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The English and American navies are practicing protection of commerce.

Then from a Cunarder this was flashed:

Sighted what looked like conning tower of submersible running awash S. E. Sable Island. Caronia.

And swiftly upon the silencing of the ticking of the message in the wireless receivers of the listening ships, corroboration came:

Independent vessel Corday confirms observation of Caronia. The Cunard line, at their London office, to-morrow meets demand of our agent, or Mauretania, sailing New York to-day, will never reach Europe. Suggest Caronia examine starboard side.

Belding, standing in the wireless station, waited in suspense while the operator strained at his instruments.

One of the other ships demanded impatiently:

What did you find?

Then came the Caronia's reply:

Torpedo, evidently with dummy head, struck us amidships. No damage done.

And from the Corday came this curt postscript:

None due—yet.

After that communication, as far as the submersible was concerned, ceased. The captain of the Britannic, the senior British commander within wireless radius, flashed out a general call; he appointed intervals at which all the ships within possible striking distance of the submarine would report themselves in rotation. So the great vessels on the North Atlantic lane steamed on, each flashing out its safety to the others in its turn, each waiting in suspense for the next one's call, each with lookouts doubled below and aloft.

Belding, on the Vidette, returned to his bridge. "I'll stand the next watch. I'll get what sleep I can now," he said to Gregory. "Call me at once, of course, if any ship ceases to report and cannot be picked up by wireless."

He went below to his cabin but could not sleep. It was not possible that the Independent Submersible—as the Corday styled itself—was yet within striking distance of ships on the Vidette's station, but Belding could not dismiss its imminent menace from his mind. The rows of deck lights of the French and English liners, which passed, glowed to him across the water. The passengers on those ships were not yet alarmed. "Maneuvers" still satisfactorly explained the sight of the war vessels. The commander of the Vidette stirred and tossed about his bunk. He had not undressed; he arose and went into the wireless cabin.

"Call the Britannic; tell the captain I advise all ships within three hours' steaming of Sable Island to extinguish all but navigation lights."

The wireless receivers recorded the accepting and carrying out of the suggestion. Then, suddenly, the liner Utrecht called and announced:

Extinguished all lights but port and starboard lanterns and masthead lights at nine-forty. At ten-five, noise was noticed close to port alongside but nothing sighted. Without other warning, large ball was thrown from water upon deck, which burst into flame, but burned harmlessly with red flame until got overboard.

Then came the wireless call curtly in the now distinctive style of sending of the operator of the Independent Submersible:

Holland-America line pays over at Rotterdam amount demanded to-day or next ball contains nitroglycerin.

Belding went to his bridge, to be almost immediately recalled y the news that the St. Paul did not report! The wireless call for the ship went out and repeated; then the calls ceased to permit the other ships to report themselves at their interval. All within wireless radius reported themselves in the routine arranged; a gap for the St. Paul; calls for it; then the roll of the reporting ships again:

The Britannic flashed this:

Volunteers to make for last reported position of St. Paul!

A British freighter, close up, responded. The war vessels already were rushing full speed ahead. Somewhere, a few miles forward of the Vidette, was the destroyer Albemarle.

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Then the St. Paul itself was heard from. This was the message:

St. Paul undamaged! Mine exploding alongside damaged adjustments radio installation; panic on board, but no fatalities.

And immediately the Independent Submersible commanded:

See that million is paid to-morrow in New York!

Belding wrote instructions swiftly for his wireless operator:

Naval defense against submarine attack is to zigzag in course; put ship to right and left sharply, each time changing duration of course in any direction.

Immediately, came this fearsome message from the submarine:

U. S. cruiser Vidette. Pick up survivors of destroyer Albemarle about fifty miles east of your announced position. It was zigzagging.

"Do you get the Albemarle? Belding demanded of the operator.

"No, sir."

"Try again. Ask other ships for interval to get Albemarle."

"Yes, sir; no response."

"What's that?"

"The Christiania, sir—reporting boats filled with men."

"Tell her not to stop; we'll pick up the boats," Belding bid.

Dawn was coming; a greasy, gray light was over the ocean. "Boats ahead!" the forward lookout hailed. The officers on the bridge now could see them clearly; under the glass, they showed to be the sea boats of a destroyer, and between the two they bore the full number of the Albemarle's commander and crew.

Young Darrell, the sublieutenant of the sunken ship, came aboard the Vidette last, and white with anger.

"They did it so darned exasperatingly," he cried. "They gave it to us, and as we were going down they came up alongside and asked if they'd injured anybody. The man speaking—in the crazy French apologies—said he personally would be desolated if he had killed us. It would be such a shock to his professional pride. He tried to figure the torpedo charge just enough to sink us; besides, he said he always avoided killing, when possible, on Sunday. They were running with conning tower awash and with the top up and he had his head sticking out. I got so mad I took a shot at him; but I missed. Some one in the submarine was going to take a shot back at us, but the first fellow stopped him. He yelled: 'Méchant! Méchant!' at me, and then put down the top of his conning tower, and sank. What did that mean?"

"Naughty, naughty!" Belding translated.

Except for an English cruiser just coming into sight, the sea was clear of ships; the passenger vessels which had kept to the lane were past and the others now were scattered far apart over the North Atlantic.

"Submarine running awash on right beam!" a lookout hailed. The American and English cruisers came about together, their quick-firers rattling into a volley. The gray, funnel-shaped and hooded conning tower of the submersible which had been moving on the surface, slipped lower, and disappeared. Instantly the cruisers separated and circled, steaming at the highest speed of their turbine engines. But the submersible either disregarded them both or failed to come close. Smoke to the east signified the nearing of a large liner westward bound from Europe; the wireless told that it was the great Gigantic. The cruisers steamed for it, met it, and escorted it each half a mile off on each side. Where the submersible lurked under the surface of the sea no one could know. The great passenger steamer, crowding its mighty engines, ran the swift scout cruisers a race to keep up; the Gigantic was trying to get into port with its passengers as swiftly as possible.

Of course, the operations of the Independent Submersible no longer could be concealed from the public ashore. The alarm leaked first, probably, through the hundreds of private radio installations along the coast of New England and Nova Scotia; also, wireless operators of ships at sea spread the news to papers for the sake of certain rewards. In all official places, both in America and abroad—at the govern-

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ment bureaus and navy departments and in the offices of the transatlantic lines—the lie direct was given to the reports which swiftly became current. The conservative newspapers also for a while denied the news; but the yellow press screamed new extras through the streets each hour, announcing more alarming and convincing details to confirm the first general reports.

It was learned that at Havre a man had been paid a large sum of money by the National Bank—a sum said to be a million francs. The fellow strutted the streets spending the money, demanding and receiving escorts of police or soldiers when it pleased him, and defying any one to molest or arrest him. He announced that, after three days, he would return for a similar payment to that just made him; or perhaps he would require twice as much; he could not say. The man was French, and recognized as a deserter from the navy who had served with those now known to be aboard the Independent Submersible.

In London, another French navy deserter demanded and drew a hundred thousand pounds on order from English steamship lines upon the Bank of England. He pocketed the bank notes and strutted the Strand, likewise elaborately defiant and unmolested. The Holland Bank, at Rotterdam, paid almost as heavily to a Gascon recently released from a French military prison; in New York, the representative of the Independent Submersible conferred, with exaggerated politeness and deprecations of regret, with the officials of the three banks where the American and European lines carried accounts; and, as shown by the moving-picture films, he left each financial institution showing marked satisfaction.

And the officials who at first denied that payment was made to these men, now took to advertising that satisfaction had been rendered. The public clamor for safety of those at sea overwhelmed all else. Governments, banks, steamship lines must pay any price to prevent disaster; relatives of those at sea demanded it; powerful individuals proclaimed contributions to subscription lists to pay the blackmail to the men of the submersible; the wireless brought from rich men at sea orders to make any promise to pay, in order to secure their safety. Hourly the newspapers printed lists of the ships at sea which were within wireless communication, and could be reported. Ships speeded into port a day ahead of schedules, discharging nerve-wrecked and excitement-exhausted passengers to swell the stories of alarm. Thousands now had seen the Independent Submersible suddenly break from the water beside the ships, insolently threaten, menace, then vanish.

In Havre, Rotterdam, Paris, London, and New York, the band of deserters and ex-convicts from the French navy made their defiant rounds of the shipping offices and banks almost daily; no one dared molest them; but now, after a week, they were put off when they demanded more money. The first terrors and excitements were dying down; the Independent Submersible had not been seen recently; moreover, as the public more coolly counted up the total damage done, it consisted of United States destroyer Albemarle, another American torpedo vessel, and one small English cruiser sunk. These had been destroyed in making attacks upon the submersible. The Corday had directly assailed no other ship except by threats; and now seemed to have left the steamer lanes. The transatlantic lines grew bolder, and advertised that the danger was over. But the cancellation of cabin reservations for all but absolutely essential business trips on the part of the public told another story; and the trebled and quadrupled marine insurance rates repeated it.

It was useless to renew the orders to the navies; war fleets of four powers patrolled the Atlantic lanes. Hydroaeroplanes, accompanying the cruisers, flitted back and forth over the sea from their platforms on the decks of the ships. Submarines with trusted crews took to the sea to aid in the search; but a submarine was almost worse than useless as a search vessel for another submerged ship; and these submersibles, when seen, either renewed terror

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on decks of passenger vessels or drew the fire of the war vessels. The submersibles were sent back to their docks in order that no ship should have to wait its fire for recognition of the target when a conning tower broke the surface of the sea.

The steamship lines faced ruin, with hundreds of millions of dollars' worth of ships idle beside the docks or sailing empty and profitless. The condition could not continue. The Independent Submersible, if it could not be destroyed, must be bought off once and for all. The maritime interests of five nations got together; not another dollar would be paid in tribute for the safety of ships voyage by voyage; together they would make up the price necessary for buying the giving up of the Independent Submersible. In Holland, France, England, the United States, the price was asked of the French deserters. In anticipation of the event, in the five countries the same figure was named—a hundred million dollars and full pardon and guarantees of protection for all the Corday's company and their agents. A war indemnity! The terms were impossible.

Lieutenant Commander Belding, on his bridge with young Gregory and Lieutenant Darrell, late of the destroyer Albemarle, learned the decision by wireless as it was flashed to the warships. It had been about noon in London when the terms had been refused; so it was still morning below the Grand Banks of Newfoundland, where the Vidette still turned on its patrol.

Evidently the Independent Submersible had been off to resupply from some secret source near Newfoundland or to meet some tramp steamer which would give it guncotton and gasoline. No ship of the patrol had reported the Corday for forty-eight hours.

This was a clear morning, sunny, mild, and beautiful. A few small fisher smacks rose and fell on the long, easy swell of the ocean; except for them, no other ship was in sight. The Vidette, pacing its beat, moved slowly and in familiar waters, but men with glasses searched the sea each moment ahead, astern, and on both beams; gun crews lounged beside loaded quick-firers, and the hydro-aeroplanes which accompanied the cruiser swooped and circled tirelessly about.

The wireless ticked in the receivers strapped over the ears of the operator at the Vidette's radio station.

"The Promethean," he named the newest and largest liner, "is coming. They've asked if everything here seems clear."

"As far as we can see," Belding directed the response. "That means, as deep as we can," he added grimly to Darrell.

The Vidette swung to meet the approach of the great new liner. A British torpedo boat skirmished ahead of it; on one side the English cruiser Terror, on the other side the American Black Hawk convoyed the great liner to the limit of its patrol where the Black Hawk would turn and the Vidette continue the convoy with the torpedo craft and the Terror. Above the mighty passenger vessel swooped the aeroplanes which were attached to the Black Hawk and the Terror. On came the gigantic vessel, with its six long decks and five funnels, steaming swiftly, majestically through the smooth sea. A few passengers, obliged to cross the ocean, stood at the rails gazing over the untroubled waters; in the holds below, as the naval officers knew, the Promethean bore the bullion and coin required to correct bank balances between America and Europe.

Suddenly the wireless crashed into the radio room of the Vidette:

S O S! Promethean sinking! S O S! Promethean.

The operator, tearing his receivers from his ears, rushed to the bridge.

"Sir!" he shouted. "S O S, the Promethean!" Then he stammered and choked. Before his eyes the great vessel was coming on powerfully, majestically, peacefully. "I got the S O S call a minute ago, sir," he explained sheepishly. "It said the Promethean was sinking——"

"Water broken ahead!" hailed the lookout from the foremast.

"Where away?"

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"There, sir!" the man pointed and shouted. Between the destroyer and the oncoming Promethean a light mast stuck from below the sea and rippled up a wave as it ran rapidly with the speed of the ship below the surface of the water. There was no time for the operator to rush back to the wireless cabin to cry the warning; no need for the signalman to flutter the alarm with his flags. The quick-firers on the forward deck of the Vidette burst into action; instantly the shells from the other cruisers ricocheted over the ripples on the water. The monster passenger vessel trembled in its course as the helmsman desperately threw his rudder to right and at the same time the engines reversed. But both actions were too late. The submersible, having taken one sight running awash, had dived. The firing from the cruisers ceased as the splash of the shells merely confused the sight of the men in aeroplanes, who dashed to the surface to try to follow the course of the submersible below. The Promethean still swerved out of its course; but the change meant merely offering the side of the great ship instead of its bow for a target. The submarine was below it by this time.

Belding and young Darrell, with the others on the Vidette, could only watch while they waited helplessly.

"That must have been the Corday that sounded the S O S in advance," Darrell said. Belding nodded, then twinged.

"There's their torpedo forward!" he cried.

Before he could have seen the splash of the explosion below the great passenger vessel, he sensed the shock to the ship.

"There goes another aft!" Darrell called; and at the stern of the Promethean a surge of white water rose at the detonation of a second naval torpedo. The liner, stricken fore and aft, staggered and stopped; on the decks panic, pandemonium, the crush and rout of terror-borne passengers. The warships, closing up, rushed to the rescue, piping crews to their boats. The hull of the giant Promethean, now drifting slowly as it settled, swayed and rolled with the smooth, easy swell of the sea. The torpedoing had been done in masterly manner, fore and aft. The bottom was blown away so that the great ship was going down gradually, evenly, not damaged more either at stem or stern; it would sink, till it was below the water, without diving. The naval officers, seeing this, sensed the intention in it; somehow the same sense that no murder had been meant seemed also to spread to the decks of the liner and to reassure those scrambling into the boats. The lifeboats filled in better order; and now about the sinking ship, the cutters of the war vessels plied with crews trained and cool. Slowly the cruisers circled the sinking wreck, halting to pick up boats which came alongside, and then steaming on around and around. Men lifted up passengers from the boats and bore them to the cruisers' decks; but at the quick-firers, the gun pointers and crews steadfastly kept their eyes alike away from the sinking ship and from the boats rowed from its side.

"But it's no use," said Gregory, as he and Belding and Darrell stood tense on the bridge watching the sea with the gunners. "The Corday's done it now and can get away—under the water five fathoms till they get two hundred miles off in any direction or it's night."

"They can; exactly," Belding agreed. "But they won't."

"You mean?"

"When they did a thing like this, we ought to get them. They were safe, as long as they could keep just threatening; but now we've got them, if we're any good."

"Why?"

"Because they're human; and they've got to see what they've done!"

"They've got to see it?"

"Yes; and see it now. A sinking ship isn't something you can come back to see after every one else is gone. They've got to see the ship they've sunk; and they've got to see it now. They'll come up, and come up close. No view through a periscope tube from below the water will do them."

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"Right, sir!" young Darrell agreed. One of the hydroaeroplanes, flying about, skipped on the water beside the Vidette. The young lieutenant of the lost Albemarle scrambled down, and, shouting for the man beside the pilot to come away, Darrell climbed into the bomb gunner's seat between the planes.

"We think they'll come up close to the Promethean, not far off!" he shouted to the pilot as the propellers roared with their revolutions and the machine rose into the air again. It circled and swooped close over the heads of the little boats rowing away from the liner; the other planes, signaled from the ship, closed in with it. Like great cormorants they soared and swooped over the water, watching for their fish to rise from below to pounce upon it.

Lower and lower in the water the mighty Promethean was settling; the liner's boats, loaded once, had got away; the cruisers' cutters now plied without passengers. All but the captain and a few of the crew were away. These delayed and now bore down to the last boats, beside the sinking ship, bags of bulk and great weight. They lowered these carefully into the boats —the gold and bullion of the Promethean's cargo. The boats pushed from the doomed vessel and rowed swiftly toward the English cruiser, nearest. But, as if this was the moment awaited, suddenly before those little boats and so close to them that the gunners at the warship's quick-firers dared not shoot the guns they sighted, a gray, funnel-shaped form broke from the water; the top tipped back, and men with revolvers confronted the unarmed boat crews with the bullion.

The captain and another officer attempted to resist, but their men struck their pistols from their hands and saved them. The French in the submersible waved their derision. The conning tower of the submarine, filled with armed men, drew closer toward the boats. It was almost upon them when suddenly and without warning either to the men in the rowboats or in the submersible, there was a whir and flash of white-clothed planes in the sun above; a swift shadow swept over the water; and an aeroplane, passing over the boats, circled, swooped, and dove. Straight at the open conning tower of the submersible it steered, and dashed so close that the men from the sea jerked down as they turned and fired their revolvers vainly into the air. So swiftly the aeroplane passed over them that it seemed nothing was done; but, as it went over, the arm of the bomb gunner dropped. The aeroplane was past; but within the ship from the sea there flashed a flame, a great puff of smoke, an explosion roared, and then the thud of a deeper detonation below the water.

The wave of this washed over the little boats weighted with bullion near by and swamped one of them and spilled the gold into the sea. Then the wave passed, and except for the other row-boats and swimming men from the first, nothing showed above the surface.

Beyond the Promethean settled a little deeper toward the bow as its top decks came even with the swell of the sea; the ship slipped lower more swiftly, cabins crashing out and bursting from the pressure of air pent up inside. And now, at last, the great ship dove; its last deck disappeared, its funnels, the top of its masts; great bubbles burst to the surface in the maelstrom of swirls and eddies; a last sobbing suck of the sea; then slowly, in little lots together, up floated deck chairs, cushions, game boards, bits of rope.

A little way off, where a few moments before the submarine had stuck its tower above the sea, other splinters of wood, a sailor's collar, a ribbon came to the surface with the last bubbles from below. A boat, rowing by, picked up the ribbon and read upon it, under the French insignia, the name of the submersible Corday.

Already the steam whistles of the cruisers were blowing; flags were flying at the tops of the masts; the wireless was spreading the news through the ether, to be borne from ship to ship to shore.

Promethean sunk, but all people saved; Corday, with all hands destroyed; the sea is safe again!

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*A glimpse of a few of the forty companies of the New York Division on the march to the parade ground*

# Something About the Junior American Guard

## The Purpose of the Movement
## What It Has Accomplished

## Some Endorsements from Leading Military Men of the United States

By Major William H. Elliott

*Adjutant General Junior American Guard, Vice-President National Amateur Wireless Association*

ALTHOUGH the Junior American Guard is barely more than six months old, it comprises forty companies of boys, and others are joining as rapidly as they can be accommodated. This is the record of achievement of a recent step for adequate national defense.

To guide boys to patriotism, self-sacrifice and devotion to the high ideals of the service is the purpose of the Junior American Guard. Military instruction which gives systematic training to the mind and body is good for the boys, good for the school, good for the country. Drill develops the whole boy—mentally, morally and physically—straightens his back, shapens his mind, stiffens his upper lip. The entire two months of the summer vacation can be advantageously spent at the Guards' encampment in hiking, swimming, boating, military instruction and rifle practice under competent instructors. Special subsubjects—field engineering, first aid to



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the injured, field sanitation, signaling, field telegraph and wireless—will be taught.

The Guard was organized in May, 1915, by Brigadier General Andrew C. Zabriskie, with the counsel and support of Major-General Leonard Wood, U. S. A.; General John F. O'Ryan, commander of the New York National Guard; Lieutenant Commander L. N. Josephthal; Major Francis L. V. Hoppin and Lieutenant Maunsell S. Crosby, all of the Governor's Staff; Major Frank B. Keck and Lieutenant Colonel Charles Elliott Warren. The Guard is non-sectarian and there are no dues, or charges paid to the national headquarters, as this is supported by voluntary contributions. Membership is open to boys between twelve and eighteen years of age, but the commissioned officers must be eighteen or over. In signal corps battalions, on account of the technical knowledge required, particularly in wireless telegraphy, the age limit is extended up to twenty-one years for privates.

The organization is divided into battalions and companies. Each battalion is commanded by a major and each company by a captain. A company consists of forty boys, including officers, and the battalion numbers not less than three nor more than eight companies, with a major and staff.

The uniform, obtainable through headquarters at No. 52 Beaver street, New York City, consists of a neat and serviceable khaki coat, cap, trousers, leggings, haversack and cap, the cost being $3.25. For about the same price a cadet rifle is furnished. It is very desirable, although not required, that boys be uniformed when they are mustered in. Experience has shown that they show much greater enthusiasm in their work when provided with the proper uniform.

The wireless work of the Guard in New York is at present under the supervision of Captain C. F. White. One radio company is now organized with headquarters at the armory of the Twenty-second Regiment, New York City. As rapidly as wireless squads and companies are completed, they are attached to Capt. White's command or placed under competent officers for their own special work. While those who wish to join the regular infantry of the guard should send their applications to No. 52 Beaver street, wireless amateurs desirous of entering or organizing radio signaling units may register with Clayton E. Clayton, managing secretary of the National Amateur Wireless Association, No. 450 Fourth avenue, New York. The Association has indorsed the work of the Guard and has offered to co-operate with it in every possible way.

It will probably interest the readers of this magazine to learn how prominent military men of the country have expressed themselves on the organization with which the National Amateur Wireless Association has affiliated. To this end are reproduced extracts from letters which have been received at headquarters. The first is from Major General Leonard Wood. He says:

"The purposes of this organization seem to be thoroughly worthy and warrant the encouragement and support of our people. The training which you propose to give the boys will tend to better them physicaly and morally and is a worthy step in the direction of training them to discharge their military obligations to the nation in case of need.

"Wishing you the largest measure of success, I am

"Sincerely yours,

Another from Col. Edwin F. Glenn, of the General Staff reads:

"I wish to commend most heartily your movement known as the Junior American Guard.

"The success of our modern industries depends more than ever upon teamwork. This can most surely be accomplished by thorough training of the individual through which he acquires a healthy body that responds promptly, accurately and effectively to his will as to the will of another in authority.

"Military training, when properly imparted, insures the best physical development of which boys individualy and collectively are capable. It makes them appreciably better producers. It inoculates

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respect for constituted authority whether of the home or of the state. It makes the boy the very best type of citizen and adds not less than five years to the average expectancy of life of those who are subjected thereto.

"If every able-bodied boy in this country were thoroughly trained and organized along accepted military lines this country need have no fear of invasion by any other nation or combination of nations.

"Universal military training and organization of our boys is one of our greatest national obligations, not only on account of the physical benefits accruing to the boy and future citizen, but because it is a fact that all wars are waged by boys from sixteen to twenty-five years of age. We owe it, therefore, to them as a sacred duty to train them for the proper performance of this obligation and through such training to develop from among them skilful officers who cannot only successfully lead them in action but protect them from diseases incident to camp life.

"Finally, this is the only method known through which adequate results can be secured with the greatest economy and with an entire absence of what is known as militarism. I earnestly hope, therefore, that your organization may reach every able-bodied boy in this country and impart to him a military training that is both thorough and effective.

"Very sincerely,

Edmund P. Glenn

*Colonel, General Staff, Chief of Staff.*

Major General John F. O'Ryan, commander of the New York National Guard, endorses the organization in the following words:

"I want you to know that I am very much interested in your movement, and if there is any way in which I can serve it, please command me. I am one of those who believes that if history teaches one thing it is that wars are fought and won by the youngsters. Therefore, I believe that in the formulation of a big, broad plan to produce reserves for war, we should not rely so much upon those who have had service in the military and who have contracted many civil and family obligations, but upon the youth of the country, who have the enthusiasm so necessary for the success in war, and who are free from the obligations imposed upon older men. If the boys of the country could be organized and disciplined and taught the elements of military training and of routine life in the open, they would constitute a very formidable and effective reserve.

"Sincerely yours,

John F. Ryan

*Major General.*

These testimonials speak for themselves and require no further comment.

Among the readers of this magazine there are hundreds who could qualify as lieutenants and non-commissioned officers of signal corps. Skilled wireless men cannot be found at a minute's notice and excellent opportunities for efficient service may be had by those who enroll under the flag in time of peace and prepare themselves to meet whatever emergency may arise.

## NEW PACK SET FOR SIGNAL CORPS

Methods of communication between armies and units of armies in time of war are important considerations, especially as the armed forces of today are growing in size and are operating over vaster distances. The Army and Navy Journal says that the Signal Corps of the United States Army is now building a new high power wireless set which can be knocked down and shipped in packages of not exceeding 350 pounds each.

Although these sets can be carried on the backs of mules or even by men they will have a sending radius of more than 250 miles. In shipping wireless outfits by rail, the set can be packed in a box car or shipped on top of a flat car, and can be set up on top of a flat car or large wagon and operated successfully. It is believed that this outfit will be particularly suited to manœuvers over mountainous country. Its parts can be carried in pack trains and can be attached to mountain artillery.

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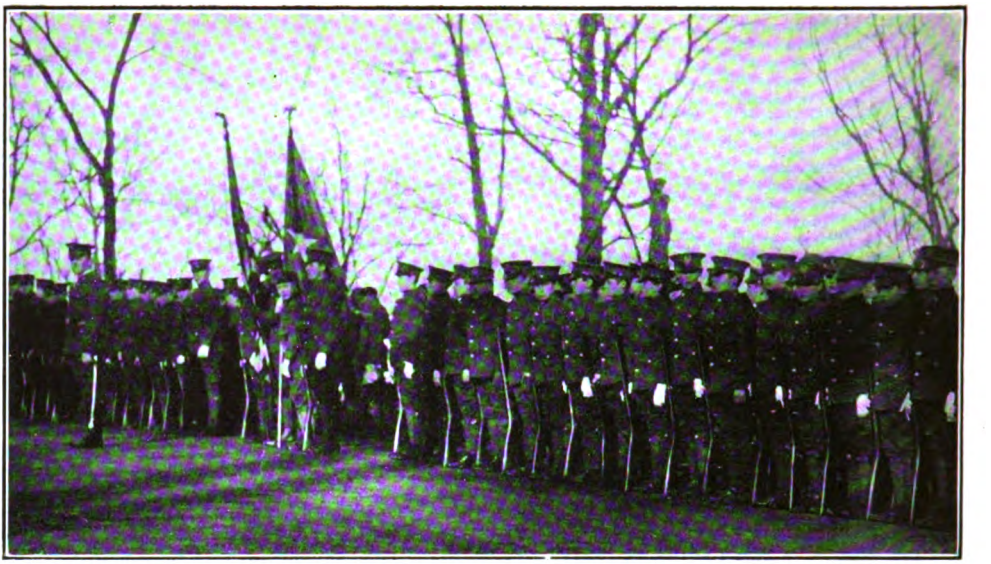

*A battalion of the Junior American Guard lining up for a parade recently held in New York*

# Preparing the Third Line of Defense

## An Outline of the Principles Governing the Organization of a Signal Corps and the Opportunities Given to Members of the National Amateur Wireless Association

**By J. Andrew White,**

*Acting President National Amateur Wireless Association*

IN the December issue, under the heading, "A Word With You," I outlined our need for preparedness and made a blanket suggestion as to how our young men can serve their country. I assumed that there were many patroitic Americans among the members of the National Amateur Wireless Association, and anticipated that a number would display initiative in the matter of organizing local signal corps. The response to the suggestion carried at the end of that brief communication has far exceeded all expectations. From the inquiries received it is evident that by the time our outdoor season arrives there will be in existence at least a half dozen well-equipped battalions trained for emergency and ready to take up practical field work in the summer camps.

Nearly every letter which has been received, however, asks for general information. The patriotic spirit is in evidence in all; but exact knowledge on the subject of signal corps, their functions and equipment, is lacking. With a view to clearing up the general questions, I shall give a bare outline of the work of the signal corps and a suggestion or two on organizing a company, and later a battalion.

The basic principle upon which signaling companies operate is to provide for transmission of information and orders from commanding officers to their subordinates and returning information



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from these subordinates to the commanders. Signal corps troops are required in event of war to be fully equipped with efficient men and material to carry out the orders of the commanding officer, regardless of adverse conditions. Uninterrupted communication must be maintained by visual or electric signaling with headquarters, no matter how often the location changes. In a phrase, the commander expects, demands and depends upon this branch of the service to keep him fully and continuously informed as to the progress of a battle, the position of his troops, hospitals, trains and supply departments.

The necessity for thorough training is therefore at once obvious. The members must be technically trained in time of peace and must be physically prepared to cover long distances quickly, overcoming all difficulties and obstacles and always keeping in touch with commanders. There is no branch of army service more important than the signaling corps, none upon which more exacting demands are made. Every man is expected to thoroughly understand all classes of signaling, know how to repair the equipment and know by extensive practice how to establish and maintain lines of communication over widely varying types of country. Drilling by the manual is but a small part of the requirements; instruction in time of peace is expected to afford officers and men practice and experience in dealing with the situations and difficulties which are likely to arise in time of war.

Raw recruits are practically valueless in an active campaign; careful training alone will make a signal corps man efficient. If war comes to this country, the *prepared* men of the National Amateur Wireless Association are the ones that can take the field at once and be of real service.

There is room in a corps for every man in a local club, the full complement of a company consisting of seventy-eight privates and thirty-five officers. Companies may, of course, be started on a smaller scale, and, where additional men are required to fill the ranks, these may be obtained from the young men of the town who are not necessarily of the wireless fraternity. No difficulty will be experienced in securing recruits, I can assure you. Once a uniformed company begins drilling—as I have seen them in New York during the past week—the difficulty will resolve itself into finding room for the many applicants.

The company, when organized, is formed into wire sections and wireless sections. A wireless section comprises all the men assigned to the establishment and maintenance of a wireless station. A pack wireless section consists of one first-class sergeant, who is chief of section; one sergeant, two corporals, operators, antenna men and messengers. A wagon wireless section consists of one first-class sergeant, who is chief of section; one sergeant, two corporals, the engineer, the wagoner, operators, antenna men, guy men and messengers.

The wire section has a first-class sergeant as chief of section, one sergeant, two corporals, operators, linemen and messengers.

*Signal corps troops are required to carry out the orders of the commanding officer, regardless of adverse conditions. Visual signaling is resorted to only when electrical means of communication fail, but every man is expected to thoroughly understand all classes of signaling*

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The men are permanently assigned to sections and are transferred by order of the captain only.

Two sections make a platoon, the chief of which is a lieutenant.

Threee platoons form a company, which is commanded by the captain.

The senior lieutenant is assigned as chief of the first platoon, the lieutenant next in rank as chief of the second platoon and so on.

The first four sections of a field wireless company are pack wireless sections; the other two are wagon wireless sections.

Electrical means of transmission include the wireless telegraph, buzzer and telephone; these are supplemented by visual means, such as the heliograph, lantern, rockets, etc., or by messenger. Visual signaling, however, is used only when atmospheric conditions or lack of equipment preclude the possibility of electrical signaling. In such emergency the flag or heliograph are used during the day, the lantern and rockets at night. Messengers are used only when other methods have been found impraticable or have suddenly failed.

Every member of a signal corps is expected to know the code thoroughly. That is one thing which members of the National Amateur Wireless Association may perfect themselves and instruct others, without further delay. If you have determined to organize locally along military lines and find that the process of organization takes time, you can do good service right away by preparing yourselves and your prospective company members in this important requirement. Practice in transmission from miscellaneous books or newspapers is strongly recommended. Hand written manuscript also affords valuable experience; the ability to read all kinds of copy—good, bad and indifferent—correctly at sight is most valuable.

Learn to read the code by sound. Two persons practicing together, taking turns at reading and writing, sending and receiving, each correcting the faults of the other, is the best method. The sounds of the code letters must first be learned separately and then short words chosen; these must be written very slowly and distinctly at first, and the speed of manipulation of the key increased as proficiency in reading is attained.

The code thoroughly mastered, equipment may be considered. The wireless equipment of the companies must depend largely upon the circumstances governing each individual case. Portable sets have been designed by our readers and descriptions of these equipments have appeared many times in issues of THE WIRELESS AGE. Any efficient set which can be easily transported and quickly set up will do at the start; special equipment will later be designed for this purpose by the staff of experts serving the National Amateur Wireless Association as officers, and these will be published in this magazine. One function of the wireless must not be overlooked in considering equipment; the signal corps is expected to keep parallel columns in communication while on the march, and possibly to intercept messages sent by the enemy—or even "jam" enemy stations when they are sending—thus the equipment selected should be both mobile and powerful,according to amateur standards.

When signal troops are in the field, whether on the march, in camp, or in combat, the detachments must be near the commanding officer with whom communication must be maintained. Signal corps officers must be more than usually efficient, therefore, and be able to effect a distribution which will best secure this result without interfering with the function of other troops. The signal officer's position is usually with the commanding general; from this point he gets a grasp of the situation and is able to direct the operations of his platoons and sections to the best advantage.

You who are members of local clubs can start your military activities whenever you choose. First, appoint a committee and decide what you can provide in the way of men and material. Then seek a man who has a military record; every town of any importance in the United States has at least one retired military officer or active militia man who is willing to head a command made up of the younger generation. Let the committee explain to him what it purposes doing, show him the article in this issue

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written by our vice-president, Major Elliott—and no urging will be necessary to have him accept the position. The properly qualified military instructor should then present his credentials in writing to the National Amateur Wireless Association and, if found acceptable, he is officially appointed captain of the proposed company. He then selects his officers, and through the local radio club, newspaper publicity and personal effort, secures recruits in sufficient number to start the local organiation.

If for any reason it is found expedient to organize independently, or to affiliate with some established church or school military company, this may be done. Preference is given to the Junior American Guard, however, because it is a nation-wide movement, supported by men of standing and organized along strict military lines. The National Amateur Wireless Association is in close touch with this organization and has an intimate acquaintance with the work accomplished and to be completed in the near future, and recommends the affiliation because of the standardized instruction which will result.

On the all-important question of financing your local company, a few suggestions are given which may be of service in solving the problem. These suggestions are not expected to be taken without whatever modification may be necessary to meet local conditions, but are to serve only as guide posts.

When official recognition has been given to the experienced military man who consents to head the company, a finance committee of three or five should be appointed. The members of this committee should be drawn from citizens of good standing in the community. It will be the duty of this committee to care for the funds of the company and, if necessary, even secure the sum necessary to give each member a uniform—costing $3.25, as explained in our vice-president's article—and to provide the signaling equipment, which may be modest or elaborate, as circumstances permit. It is not necessary to purchase rifles; signal corps members are provided only with revolvers.

If the individual members can provide, from their own pockets, the small sum necessary for the purchase of equipment, this is the best and most dignified thing to do. It may be, however, that the parents of a few young men cannot afford the modest sum required. In this case

*This illustration shows a sham battle in progress on Washington Heights, New York, and gives some indication of the instruction in time of peace which is expected to afford officers and men practice and experience in dealing with the situations which are likely to arise in time of war. The commander of infantry troops such as these depends upon the signal corps to keep him continuously informed as to the progress of a battle*

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the deficiency may be made up by the members in better circumstances, or, if this fails, the finance committee should be required to provide a way of securing whatever funds are necessary to complete the organization.

There are several ways in which the result can be accomplished. Local merchants and prominent men of the town, if properly approached and assured that the committee is composed of responsible people and the captain a capable officer, will readily give tangible evidence of their patriotism by furthering a worthy cause. If contributions are solicited, however, the organization must have established a definite standing in the community and secured a bank connection or recommendation that will set at rest any doubts as to the sincerity of purpose. Young men should not undertake solicitation of funds—even though the amount be small—unless they first secure the written endorsement of three or more of the most prominent men in the community.

Another way in which the equipment may be secured is through the church. A number of companies and battalions of the Junior American Guard are maintained by New York churches, the members of the congregation taking great interest and pride in the careful training secured under proper instructors.

A signal corps is also a logical project for the schools to further. Principals of private, and even public, institutions are influential men and can easily create a local organization, if their support can be enlisted.

There are, of course, many other ways in which the financing of the corps may be accomplished. But the best way of all is for the members to do it themselves by each individual providing his own equipment. The main issue is to get started; then initiative and resourcefulness of those really desirous of preparing themselves in event of war will solve the problems as they are encountered.

New York is certainly setting a pace that other sections of the country will have difficulty in following. So well have the organizations progressed here that plans are now being made for a monster review within a few months, a parade in the spring and a great summer camp and field maneuvers later in the year. The National Amateur Wireless Association is extending active c-ooperation in the signal corps work and is well equipped to serve in similar advisory capacity its members scattered all over the nation. Major Elliott wishes me to personally extend to all association members a cordial invitation to join the preparedness movement, together with assurances that prompt attention will be given to all applications from men who wish to qualify as captains.

## THE GROWTH OF THE DEFENCE MOVEMENT

The national defence movement in which wireless telegraphy is playing an important part, is showing a marked development in northern New York. Among the up-state cities, Buffalo reports more than 1,500 recruits, practically a full, war-strength regiment. In Rochester the Headquarters' Staff of the Rochester National Defence Contingent reports an enrollment of 250 at the first meeting, with good prospects for a much longer muster roll before spring. An opportunity will be given those who wish to take a course in wireless practice in addition to regular drill. A. M. Lindsay, Jr., has donated his service as instructor in the art.

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The Lloyds Register for 1914-15 says that there has been a steady growth in the number of vessels equipped with wireless and submarine signaling installations. There are now on the Lloyds registry of the world's merchant marine 2,939 ships fitted with wireless sets and 947 equipped with the submarine apparatus.

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# How to Conduct a Radio Club

*(Specially Prepared for the National Amateur Wireless Association)*

**By Elmer E. Bucher**

## ARTICLE XX

BECAUSE there is little or no retransfer of energy from the antenna to the spark gap circuit, the quenched spark discharger is considered the most efficient of modern gaps for the handling of small powers. Some amateurs, ambitious to obtain the maximum degree of efficiency from their transmitters, fit their stations with gaps of this type, but the results obtained are frequently somewhat disappointing. Considerable misapprehension seems to exist regarding the adjustment and use of the quenched spark discharger and this article was written with the object of bringing about a better understanding regarding the subject.

To be efficient, the quenched spark type of transmitter must be uniformly designed throughout; that is to say, the generator, the transformer, condenser and gap must be constructed along certain definite lines before the apparatus can be expected to produce results. It is not within the scope of this article to discuss the design of a complete commercial quenched spark type of transmitting apparatus, but directions will be given which will enable the gap to be employed in connection with any type of existing amateur apparatus with increased flow of antenna current. The adjustment of the quenched spark transmitter, even when properly designed, is somewhat difficult and it is due to the absence of the necessary controlling devices for obtaining closeness of regulation of the various circuits that the amateur meets with discouragement.

As is well known, the plates of the quenched gap are made of copper, carefully ground and perfectly milled, with sufficient heat dissipation surface to take care of the required energy. In addition, the individual plates of the gap are separated by insulating washers of the correct thickness, so that when compressed the sparking surfaces will be separated by no more than 1/100th of an inch. It is particularly important that the space between the sparking surfaces be air-tight. To this end the insulating discs or washers are treated with a special insulating compound, such as varnish, paraffin, etc. Under the heat of the gap this compound will soften and when the plates are tightly pressed an air-tight joint results.

It is customary to allow 1,200 volts per gap; hence the number of gaps to be employed in a given set can be readily calculated from the applied voltage. It should be kept in mind, however, that it is not the voltage of the transformer alone that is taken for computation; it is the available potential when the condenser is connected in shunt to the secondary winding that is taken into consideration. This value of potential can be calculated by the sphere gap method, the tables for which are usually given in the appendix of electrical hand books. Briefly, this method involves the use of two spheres or balls of a certain diameter, which are separated by a micrometer adjustment with a corresponding scale. These discharge balls are connected in shunt to the source of high potential and gradually separated until the spark ceases to discharge. The length of the gap is noted and reference made to the table for the corresponding value of voltage. It should be kept in mind that these tables generally give the maximum voltage per cycle and not the R.M.S. value.

The writer conducted a number of ex-

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periments with quenched gaps on sixty-cycle amateur apparatus and found that with the proper precautions increased flow of current in the antenna circuit could be obtained. As a result of these tests it was immediately observed that the capacity of the condenser in the closed os-

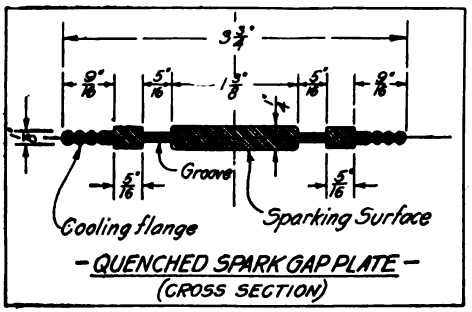


*Fig. 1*

cillatory circuit must be reduced below that value employed with the plain type of spark gap.

An additionally important factor in connection with these dischargers is the pitch of the note. To secure a clear tone it is necessary that the voltage applied to the high potential condenser should be very carefully regulated. When the source of current supply is a motor-generator, the voltage of the transformer may be readily controlled by means of the generator field rheostat. However, when current is taken from the city mains, it may become necessary to construct a transformer fitted with variable tap-offs in the secondary winding in order that the correct value of voltage may be obtained. With certain transformers the proper reduction of voltage may be secured by the insertion of a reactance coil in series with the primary winding, but this method is not found to be as efficient as the one where tap-offs are taken from the secondary winding.

Some experimenters believe that the mere fitting of a quenched gap to a radio transmitter will give a high spark note. This is not true. But if properly adjusted this gap will tend to smooth out the pitch of the note regardless of the applied frequency. High pitched notes are only obtained within the higher range of spark frequencies (from 240 to 500 cycles).

It is essential in connection with the quenched spark transmitter that the inductance value of either the primary or secondary circuits of the oscillation transformer be continuously variable, *i. e.*, fitted with a sliding contact in order that turns may be added or subtracted by fractions of an inch. It is preferable then to employ an oscillation transformer of the pancake or flat spiral type in order that sliding contacts may be fitted for variation of the inductance. Again, the coupling between the primary and secondary windings must be very closely adjustable, and if possible the oscillation transformer should be constructed so that the inductance of either the primary or secondary winding and the coupling between these windings can be varied simultaneously.

At this point it should be kept in mind that the quenched spark discharger permits a closer degree of coupling between the primary and secondary windings than is possible with the rotary disc discharger or plain gap. On this account an increased flow of antenna current takes place and in addition the energy is

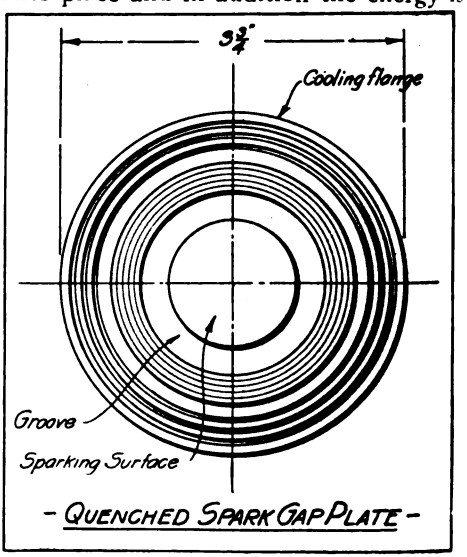


*Fig. 1-a*

emitted at a single fundamental frequency.

The high potential transformer for a quenched gap system should possess a certain amount of magnetic leakage. The open core transformer naturally possesses this characteristic, but if a transformer of the closed core type is employed

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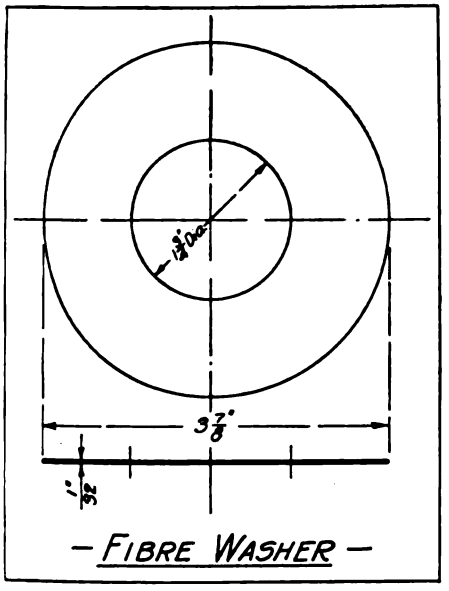


Fig. 2

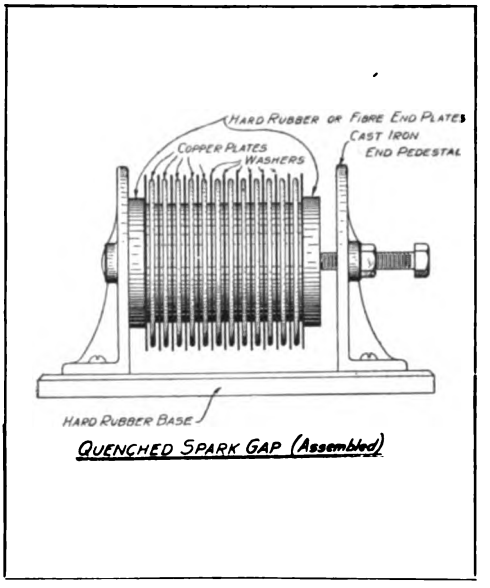


Fig. 3

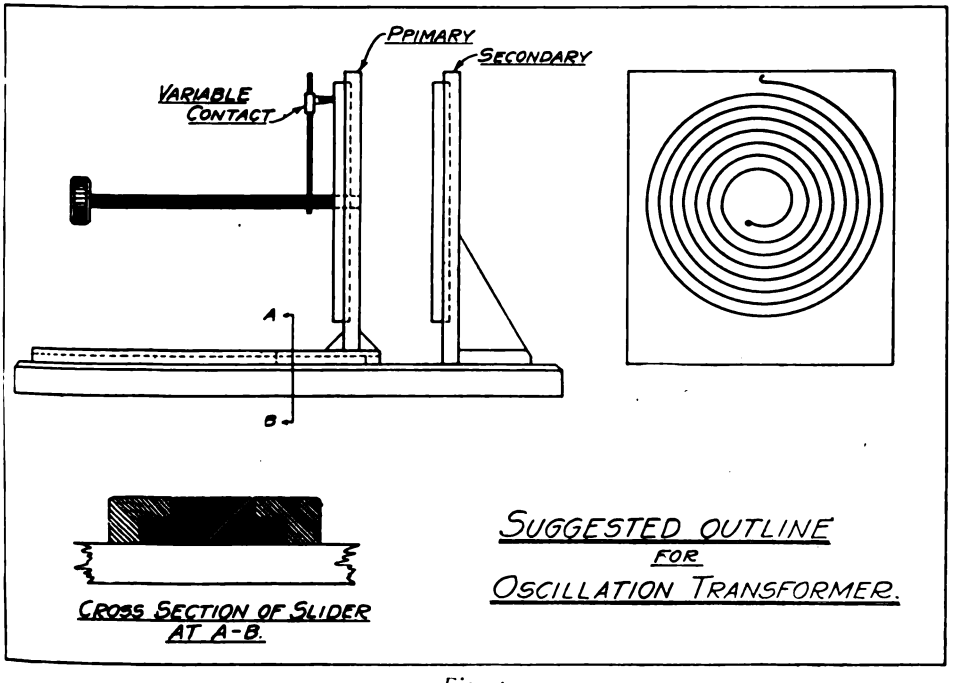


Fig. 4

it should be fitted with a magnetic leakage gap.

The average amateur transmitting set supplied with a ¼ or ½ k.w. transformer, requires from 8 to 14 copper plates for the quenched gap, which may be designed from the sketch shown in Fig. 1, a plan view of which is shown in Fig. 1-A. As indicated, the actual sparking surface of the plates is 1⅜ inches in diameter, surrounded by a groove 5/16ths of an inch in width by about 3/32 of an

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inch in depth. It will also be observed that the outer rim, upon which the insulating fibre rests, is 5/8 of an inch in width by 1 5/8 inches outside diameter. The complete plate, including the cooling flange, is 3 3/4 inches in diameter.

The plates of a quenched spark gap cannot be constructed in a slipshod manner. They must be cast in a solid piece and very carefully molded. In fact, it is not sufficient that these plates be smoothly cast. They must be placed in a lathe or milling machine and ground to a smooth surface with extreme accuracy. If the sparking surface is uneven the spark discharge will take place at the highest point and finally short-circuit the gap.

After completion these plates must be carefully mounted in a containing rack and placed under great pressure. The junior experimenter is accustomed to stack these plates between two insulating slabs and draw them together by means of iron bolts. It is impossible to compress the plates evenly in this manner. As a matter of fact, efficient results cannot be expected unless the plates are mounted in a cast iron frame, properly insulated from it and pressed together by means of a large set screw on the end which acts directly upon the center of the plates. In this manner a great pressure can be exerted, making the intervening spaces airtight.

The dimensions for the insulating washers are given in Fig. 2, the suggested outline for the design of a gap container in Fig. 3, and a simple sketch of a suitable oscillation transformer in Fig. 4. Complete constructional details of the oscillation transformer are not given, but for amateurs' information it can be stated that they are generally constructed of strip copper, placed in slots cut in spiral form on a slab of hard rubber bakelite or other insulating material.

For operation at a wave-length of from 200 to 600 meters the oscillation transformer for a 1/2 k.w. set may have the following dimensions: ( The primary winding has eight turns of flat copper ribbon placed on an insulating support edgewise, the copper being 3/8 of an inch in width by 1/16 of an inch in thickness. The outside diameter of the winding is 10 inches and the inside diameter about 4 3/4 inches. The turns should be placed 1/4 of an inch apart. The secondary winding of this oscillation transformer may consist of nineteen or twenty turns of ribbon of the same size, also spaced 1/4 of an inch apart, with a copper strip of the same dimensions. The outside diameter is about 14 inches and the inside diameter about 4 1/4 inches. It will be observed from Fig. 5 that the inductance of the primary winding of the oscillation transformer is altered by a

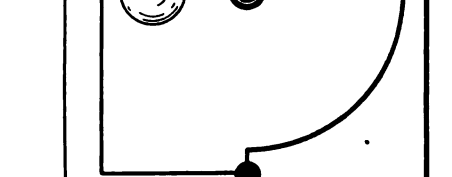


*Fig. 5*

sliding contact operated by the handle, h. In addition, the primary winding is mounted on the base so that it can be drawn away from the secondary winding for variation of the coupling.

A radiation indicator suitable for determining conditions of resonance between the spark gap and antenna circuits is shown in Fig. 5. It is, of course, preferable that a hot wire ammeter be employed, but in the event that it is found

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too expensive the indicator will fulfill the requirements. It consists merely of a two or four volt battery lamp, shunted by a semi-circle of copper wire with a sliding contact, so that the inductance and resistance of the shunt can be regulated by fractions of an inch. When this indicator is connected in the antenna system, experimental trials must be made and the shunt set at the correct value to prevent the lamp from burning out. A diagram of connections for the complete quenched spark gap system is shown in Fig. 6.

Assuming that the experimenter has constructed a quenched gap along the lines described and that the plates are properly mounted in the containing rack and made airtight, if the following procedure is carried out efficient results will be obtained.

As remarked previously, the capacity of the transmitting condenser should be reduced and corresponding careful regulation made of the number of gaps in use as well as the applied potential. Here it should be remarked that when first assembled the quenched gap is not in condition for immediate use. The spark should be allowed to discharge for at least two hours to remove the accumulated gases. After being treated for this period the primary winding of the oscillation transformer is placed in close inductive relation to the secondary winding and extremely careful regulation made of the inductance of either winding; at the same time the antenna current indicator should be noted to determine when the maximum flow of energy is obtained. When this point of adjustment is reached, the coupling between the primary and secondary winding is reduced with simultaneous small changes in the inductance values of the primary winding with the idea of ascertaining whether increased antenna current can be obtained. During this adjustment the pitch of the spark note can be observed by listening in on the telephones of a wavemeter adjusted to resonance with the set, or by connecting into the circuit the secondary winding of the receiving tuner. Careful adjustment of the transformer voltage is made and the corresponding note observed in the telephones.

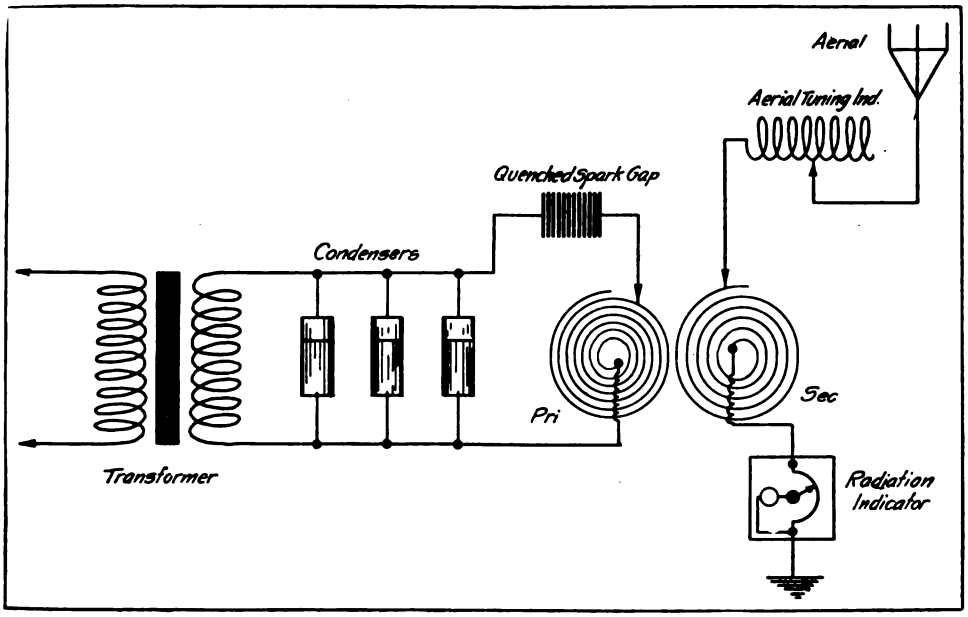


Fig. 6

It is important that the plates of the quenched spark gap be properly cooled. It is customary in commercial apparatus to effect this by a small motor blower mounted directly on the same base with the quenched gap which supplies a constant pressure of air to the outside surface of the plates. Similar results can

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be obtained by using a small electric fan arranged to direct a blast of air upon the cooling flanges. A slight rise in temperature has the effect of increasing the efficiency of the gap, but if excessive the plates will be ruined. After a few hours' use it is found necessary to gradually take up the adjusting screw in order that the plates may be kept airtight.

It will readily be understood from the foregoing explanation that the oscillation transformer of the conductive or inductive type employed at the amateur station is unfitted for use in connection with the quenched gap system. While it is possible by a tedious series of experiments to locate the proper values of inductance, it is far more preferable to build an oscillation transformer after the type suggested.

The writer feels assured that if the experimenter will adopt the foregoing suggestions he will not discard the quenched spark discharger as useless, but will be loud in praising its efficiency.

*(To be continued)*

## BRIDGEPORT NAVAL SET INSTALLED

The wireless equipment of the National Guard received a valuable addition recently when the Bridgeport battalion of the Connecticut Naval Militia installed its radio apparatus in the State Armory. The antenna was strung above the roof from front to rear.

Four members are already excellent operators. With the exception of the tuning coil the receiving set is entirely home-made, and the sending set, while made up of regular stock parts, was assembled by the radio class. This work, while encouraged by the Navy Department, is optional.

Previous to the armory installation the battalion set was in use at its club house, where communication was established with a number of stations along the Atlantic coast. With the new equipment, a larger class and better results are expected.

## EXAMINATION FOR RADIO INSPECTOR

The United States Civil Service Commission held a competitive examination on January 19 to fill vacancies on the force of radio inspectors and their assistants in the offices of the Radio Inspectors of the Department of Commerce in New York and San Francisco. The salaries for these positions range from $1,200 to $1,600 a year, depending on the candidate's qualifications, as shown by his examination. The examination was open to men of twenty years and more.

As most of the readers of THE WIRELESS AGE know, the duties of the inspector are to aid in the enforcement of the government wireless regulations through the inspection of ship and shore stations, to insure their compliance with the law. They may also be called upon to examine radio operators. As the inspection work requires the assistant to carry thirty or forty pounds of testing and measuring instruments, a good physique is a prime necessity, and a medical certificate of fitness was required of each applicant.

## COST OF PEACE SHIP MESSAGES

The first member of the Ford expedition to return to this country was Robert Bastian Bermann, of Washington, D. C., who was engaged to supervise all copy before it was sent out to Kings, Presidents and other distinguished persons.

Mr. Ford's staff consisted of twelve stenographers, four multigraph operators, five dictaphone operators, seven publicity men and six messengers, according to Mr. Bermann, who said that the staff was kept busy getting out messages which were dispatched by Marconi wireless continuously.

According to a newspaper interview, as many as 40,000 words were sent in one day, Mr. Bermann asserted, and he had to read and correct them. Mr. Ford sent a message of 600 words to each of nine rulers of belligerent nations at 50 cents a word, and the bill paid at Kirkwall for the total wireless amounted to $50,000, the wireless editor declared.

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# Vice-Presidency of National Association Accepted by Capt. Bullard

## Superintendent of Naval Radio Service Added to Distinguished Advisory Board Expresses Desire to Aid in Uplift of American Amateur Experimenting

LAST month this magazine, as the official organ of the National Amateur Wireless Association, had the privilege of announcing that Secretary of the Navy Daniels had approved the organization and requested that a list of members be prepared so that they may be communicated with, and those willing to serve as volunteers in event of war, registered in the government records. Close upon this comes another indication of the high esteem in which the government holds the Association—an acceptance of a vice-presidency on the Advisory Board from Captain W. H. G. Bullard, Superintendent of the Naval Radio Service.

In the letter which announced this important decision, Captain Bullard clearly expressed his willingness to give his personal support to the uplift of the wireless amateur.

He said that he felt "honored in being associated with so many distinguished gentlemen in the proposition directed towards the uplift of the amateur wireless man, to the end that both commercial and governmental interests would be safeguarded, and the amateur himself placed in a position of responsibility." He added that he trusted his connection in an official capacity would "redund to the credit of the Association."

The letter closed with an expression that will be of particular interest to every amateur in the country: "I shall do all that is proper to bring about the desired result, and I've no doubt that my efforts will be successful."

This communication to members might well be said to mark an epoch in the history of American wireless telegraphy. The strong endorsement contained therein vindicates the contention which prominent experimenters have advanced through years: That with proper organization radio investigators could secure Federal recognition as conscientious workers in the field of science, individually and collectively to be aided and encouraged in research of value to the nation. Captain Bullard's expressed willingness to aid the promotion of amateur wireless and his position on the board of vice-presidents is a cause for congratulation; his views, together with those of the eminent scientists who have graciously consented to further the experimental work pursued by members, makes certain that the value of the counsel given to the National Amateur Wireless Association will be the best obtainable.

The administrative officers have urged that every amateur wearing the national emblem be constantly reminded that it is to be looked upon with justifiable pride as representing its wearer's acceptability to participation in the activities of an organization made possible only through the willingness of the leaders of science to aid a worthy cause. Every member is pledged to conduct himself in a manner to reflect credit upon the Association, recognizing that an unusual distinction has been conferred upon the radio field.

A formal expression of appreciation of the additional honor conferred upon the Association in Captain Bullard's acceptance has been made and the current Monthly Service Bulletin sent to members carries special mention of the notable acquisition to the list of officers.



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# THE WIRELESS MEN

## By Walter Willisson Stephen

Our tidings we breathe to the powers of the dark,
and the demons that dwell in the air;
And unto the flickering fire of the heavens we
answer the lightning's flare.
We hark to the voice of a comrade that speaks of
the tempest arising afar
Where the shimmering line of the sky and the ocean
is under the pale North Star.
We have seen the white glow of the withering moon
aflame on the tropical sea,
And the palm tree's tracery under the sky on the
beach of the white sand key.
The winds of the firmament pause to our bidding,
then hasten their missions again;
And we know in the night when a brother is near—
for we are the wireless men.

We trust to our towers of the tightened steel where
the static glimmer clings,
While the hurricane drones through the phosphor-
bronze with the lay that the storm god sings.
We shatter the peace of a continent's sleep when a
colleague calls relief,
When the steam is low and the liner's keel is agrind
on the wave-wracked reef;
And into the murk where the elements mingle and
madly the furies shriek,
We pilot the sheer Cyclopean prows to the foun-
dering goal they seek.
And whenever the demons down under the ocean
refuse to be denied
We can only pray that we meet our God as the
wireless men have died.

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# From and For those who help themselves

## Experimenters' Experiences.

*The editor of this department will give preferential attention to contributions containing full constructional details, in addition to drawings.*

### FIRST PRIZE, TEN DOLLARS
### The Construction of a Strong Aerial Mast

A problem ever before the wireless amateur is the construction and erection of a satisfactory mast for support of the aerial wires. The mast I am about to describe has withstood three years' service and bids fair to last an indefinite period. Details of construction and erection are give in Figs. 1 to 6. Fig. 1 shows that the complete mast is made up of three sections of clear, straight pine, each section being 20 feet in length. The bottom section is of 3 inches by 3 inches stock, the second section 3 inches by 2 inches, and the top section 2 inches by 2¼ inches. They are lapped at the joints as indicated, being fastened together with two bolts.

It should be noted that the top portion of the lower section is cut out at the joint so that the weight of the upper section will not rest solely upon the two bolts. A brace is placed in the middle of the second and third sections, being fastened in place by screws. The brace wires are passed through holes bored near the end of the braces. The wires permit the use of smaller lumber, thereby decreasing the cost of construction. The guy wires proper are arranged in three sets of three each, making a total of nine wires, as shown in Fig. 2. No. 12 B. & S. gauge galvanized wire was found satisfactory, but the continuity of the circuit to earth is preferably broken up by porcelain knobs at intervals. The guys are fastened to the mast at the joints with eye bolts.

A swivel pulley of sufficient size to take a ¼-inch hemp rope is mounted at the top of the mast. A screw eye bolt is placed about 6 feet from the lower end of the mast and the rope (having previously been pulled through the pulley) is put through the screw eye and tied, making an endless rope so that when the mast is raised the rope will not slip off or out of the pulley. After the mast is up the knot is untied and one end of the rope fastened to the aerial. The other end of the rope passes through the screw eye and is fastened to a concrete weight which will be described in another part of this article. Before it is erected the mast should be given two coats of white paint and two coats of black tar paint on the first four feet of the first section.

The erection of a mast is sometimes a difficult problem, but if the following directions are obeyed the procedure is simple. A hole, 8 inches square by 2 feet 3 inches in depth, is dug in heavy soil. If the builder desires to set the mast in concrete he should pour about three inches of it into the hole and allow it to set; if it is not intended to set the mast in concrete a flat stone slab should be placed in the bottom of the hole. I have found that if the base of the mast is coated with tar paint it will last for an indefinite period regardless of whether it is set in concrete or not.

To facilitate the erection of the mast



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a board is placed at one side of the hole, as indicated in Fig. 4. This is intended to prevent the mast from jumping or sliding over the hole while being raised. A pulley, a, is fastened to a tree or shed about 30 feet from the base of the mast. In the event that a tree or shed is not handy a 20-foot piece of 2 x 4 lumber should be erected and properly braced (Fig. 4).

A rope, b, is then fastened to the end of the middle guy wire (Fig. 4). In addition a 2 by 4 piece is constructed, as shown in detail in Fig. 3, and is further indicated at C in Fig. 4. During the process of erection one person should heave on this prop. Station two assistants, one at D and one at E, to hold the guy wires to prevent side sway. In the meantime C pushes on the 2 x 4 prop while one or two boys pull on D; the mast will rise slowly at first but the nearer vertical it becomes the less difficult will be the erection. Before the guy wires have been fastened to the mast they should be accurately measured and the necessary stakes driven about the base of the mast. For one of this construction the stakes should be placed at least 25 feet from the base. They should be constructed to extend about 6 inches above the ground. Care should be taken as the mast approaches the vertical position to make use of the main guys to prevent it from swinging forward because the leverage may be sufficient to tear out the hole at the base.

To keep the aerial wires taut a concrete weight attached to the end of the rope is recommended. It should be molded in a wooden box with a small amount of concrete. Fig. 5 will make clear the method by which the screw eye is fastened to the concrete.

A sketch of a small box to cover the pulley at the top of the mast is shown in Fig. 6. This can be made of ¼-inch stock of the dimensions given. This box will prevent the pulley from becoming frozen to the rope during the winter. Thus when the aerial wires become covered with ice the pulley is free to revolve and the aerial will raise the weight and thus reduce the strain on the mast.

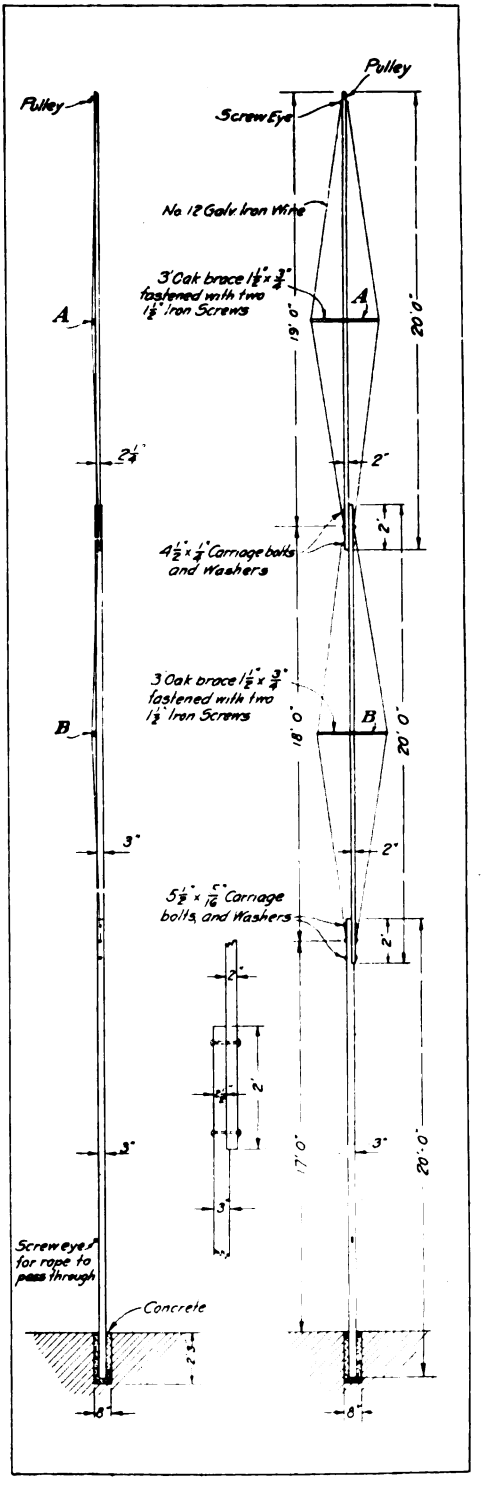


*Fig. 1, First Prize Article*

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I constructed a mast of this type having a height of 54 feet at a cost of $3.

H. E. LANGE, *Missouri.*

## SECOND PRIZE, FIVE DOLLARS
### A Receiving Detector That Is Easy to Adjust

The designs of receiving detectors vary considerably, but the one shown in the accompanying drawing surpasses any mineral detector with which I have experimented. It is simple in construction, requires small space and is easy to adjust, with the advantage that when the sensitive point is once located, the detector remains in that condition indefinitely. I consider the drawing so clear that no lengthy explanation is needed.

The upright arm and point container are made of fairly heavy square brass rod. The point container may be made from round rod, but I prefer the square rod for appearance. This is drilled and tapped for an 8/32 screw to within a short distance of the end. From this point on the hole is made quite small. The construction of the adjustment screw should be perfectly clear from the drawing and the attention of the builder is particularly directed to the method in which the spring and the phosphor bronze wire point are constructed.

The cup containing the minerals, of which there may be any number consistent with the swing of the arm, is mounted upon a disc of ⅛ of an inch brass or copper, having a knurled hard rubber ring for the purpose of turning the various crystals into position. The size of this disc depends, of course, upon the number of minerals which are to be used. If the design indicated is carefully followed a detector which will be a credit to any amateur station will result. It is recommended that the component parts be mounted on a polished hard rubber or fibre base.

B. B. ALCORN, *New Jersey.*

## THIRD PRIZE, THREE DOLLARS
### A Rectifying Detector in Use at Amateurs' Stations

It is becoming the custom at amateurs' stations to construct a rectifying detector modeled in some respects after the original Marconi coherer. The advantages set forth are that a sensitive point is more easily located and the detector cannot be put out by vibration or heavy atmospheric discharges. A sectional view of one I designed is shown in Fig. 1, details of the base are given in Fig. 2, and the details of the detector proper in Fig. 3. A side view of the device is represented in Fig. 4 from which it is clear

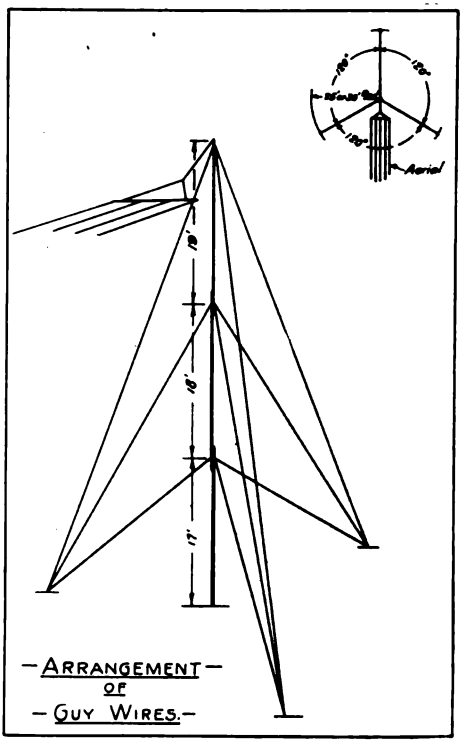


*Fig. 2, First Prize Article*

that the detector is mounted in spring brass clips so that it can be revolved for purposes of adjustment or readily removed. The details for the clips are fully given in Fig. 5.

It is clear from Fig. 1 that inside the tube there is attached to one of the brass lugs a silicon crystal which may be placed in position by means of soft metal. This crystal makes contact with a mixture of filings made up as follows: Ten parts of pure silver filings, five parts of galena and silicon filings, and one part of nickel filings. While the foregoing proportion of in-

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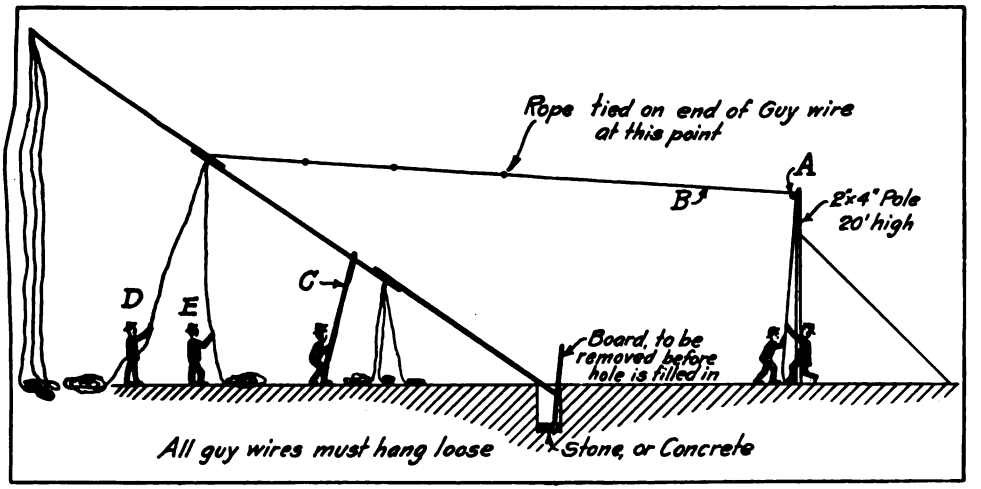


*Fig. 4, First Prize Article*

gredients has worked successfully, it is recommended that the experimenter try other combinations or proportions until the best results are obtained. It might facilitate the adjustment if the device is constructed so that when one of the brass lugs is turned the other will remain stationary. This can easily be accomplished by making the plug, C, have a little more friction inside of the tube, D, than the opposite plug. It has been found by experiment that a good galena crystal can be substituted for the solid silicon crystal.

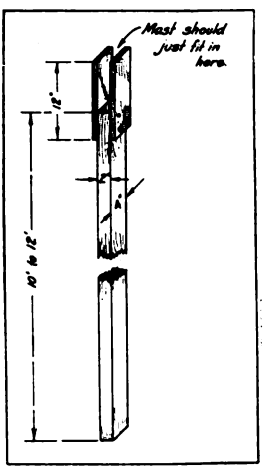


*Fig. 3*
*First Prize Article*

When properly connected to a receiving detector circuit the detector may be adjusted either by rotating the tube or by increasing or decreasing the pressure on the brass lug. It is also customary to excite some portion of the secondary winding of the receiving tuner with a buzzer excitation circuit, thereby causing the filings, which seem to automatically select a sensitive spot for rectification, to cohere.

O. COTE, *Rhode Island.*

*The editor of this department will be glad to consider articles on the construction and cost of amateur high potential transformers.*

## FOURTH PRIZE, SUBSCRIPTION TO THE WIRELESS AGE.

### A Rotary Quenched Spark Transmitting Set.

From the standpoint of the amateur experimenter the rotary quenched spark transmitter is one of the most efficient of modern types. In a general way it possesses the efficiency of the conventional quenched spark gap discharger with the additional advantage that a high spark frequency can be obtained from a sixty cycle source of energy. The antenna current from a set of this type is usually rather high and the spark note is perfectly clear and easily read through static or other interference. With the exception of the spark gap and the transformer the set I am about to describe is of the usual type. It will be observed from Fig. 6 that the spark gap is mounted in an air-tight case comprising the following parts: A cast-iron case, a rotating member, two semi-circular stationary electrodes, and a fibre disc upon which the stationary electrodes are mounted.

As shown in the drawing, the rotor is a brass disc, 4¾ inches in diameter, with twenty projections or sparking

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points on its face. In the construction of this disc it is necessary to make a brass casting and to turn it down on a lathe to the size shown in Fig. 2. Twenty slots, each 7-16 inch in width

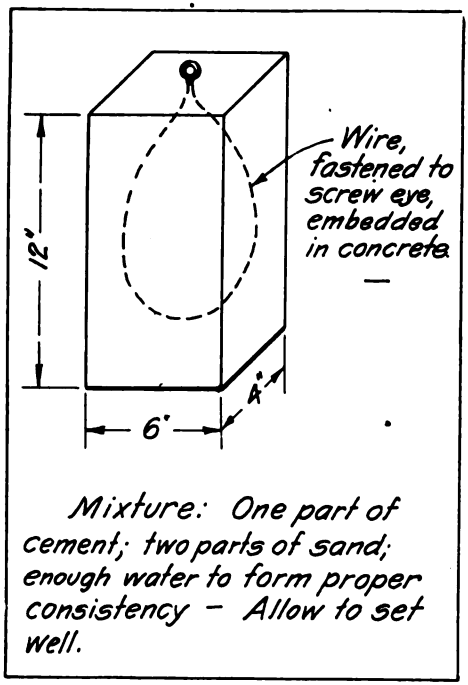
Wire, fastened to screw eye, embedded in concrete
12"
6"
4"
Mixture: One part of cement; two parts of sand; enough water to form proper consistency - Allow to set well.

*Fig. 5, First Prize Article*

by 1/8 inch in depth, are milled on the rim, resulting in the production of twenty wedge-shaped projections on the face of the disc. These are the sparking points. The disc is then mounted on a drill rod shaft, 5-16 inch in diameter by 3 inches in length, and is then ready for use. The driving motor is preferably insulated from the shaft of the motor; a small short section of thick walled rubber tubing is very satisfactory for this purpose.

The two semi-circular stationary electrodes are made from a disc, the construction being similar to the rotary electrodes. After the slots have been milled in the rim, the disc is cut into two pieces, making two flat plates with projecting sparking points, as shown in Fig. 3. Two holes are drilled and tapped for 14-20 screws in each plate. These holes are located on a circle of 1¼-inch radius and are 90 degrees apart. The plates are mounted upon a circular fibre disc, ½ inch in thickness and 4¾ inches in diameter, as per Fig. 8. They are held in place by means of four 14-20 brass bolts, each 1 inch in length. The bolts are provided with hexagonal lock nuts and knurled thumb nuts which serve as terminals. Care should be taken that these plates are mounted with the teeth in line with those of the rotary plates.

Details of the cast-iron case are given in Figs. 5, 6, and 7. As indicated in the drawing, the face of the rim upon which the fibre disc is mounted must be machine finished in order that the joints may not leak air. When the gap is assembled vaseline is used to seal the joints. The disc is attached to the case by means of eight iron screws,

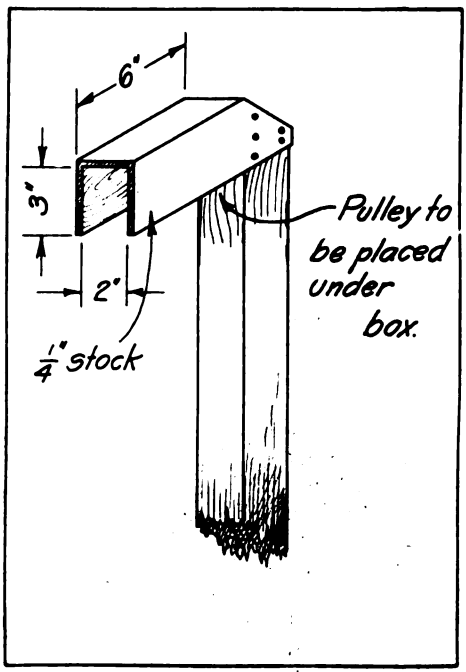


*Fig. 6, First Prize Article*

8/32 by ¾ inches in length. The holes for these screws are located forty-five degrees apart on a circle of 2¼ inches radius. A bronze bearing, 9/16 of an inch in diameter and 1½ inch in

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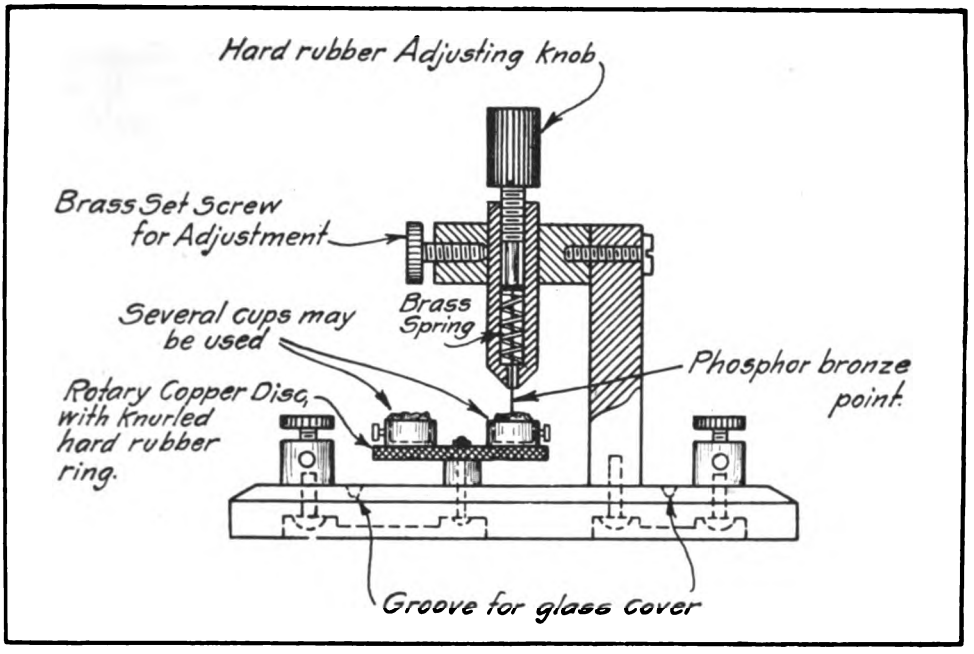
Hard rubber Adjusting knob
Brass Set Screw for Adjustment
Several cups may be used
Brass Spring
Phosphor bronze point
Rotary Copper Disc with Knurled hard rubber ring.
Groove for glass cover

*Drawing, Second Prize Article*

length, is fitted into the hub of the case. The oil cup shown in Fig. 6 is of the wick type. The bearing at this point must be a close fit and must be kept well lubricated in order to exclude the air.

The remaining parts of the complete set are of the conventional type, with the exception of the transformer, which has a secondary voltage of 3,000 volts. The apparatus also includes a small plate glass condenser of .02 microfarad capacity, a pancake type oscillation transformer and a motor which is capable of driving the gap at a speed of 5,000 revolutions per minute.

The 3,000-volt transformer has the following dimensions: The core is 12 inches in length by 9 inches in width, with a cross section 2 inches square. It is made of .017 of an inch silicon steel. The primary winding has 150 turns of No. 12 D. C. C. wire and the secondary winding 4,800 turns of No. 30 D. S. C. wire in twelve pies. Each pie is ½ inch in thickness and has 400 turns per pie.

The high potential condenser is made up of sixteen photographic plates, 10 by 12 inches, with a thickness of .05 of an inch, covered on both sides with tinfoil 8 by 10 inches. The plates are all connected in parallel and will give a resultant capacity of approximately .02 microfarad.

The oscillation transformer is of the pancake type, the primary winding consisting of four turns of 1/16 of an inch copper ribbon. The inner turn of the primary is 5 inches in diameter and the other turns 5.5 inches, 6 inches and 6.5 inches respectively. The inner turn of the secondary winding is 4 inches in diameter, each succeeding turn being ½ of an inch larger, the outer turn thus having a diameter of 7.5 inches.

A diagram of connections for this set is shown in Fig. 10. The apparatus is mounted in a mahogany cabinet, as shown in Fig. 9. The inside dimensions of this cabinet are 16 by 12¼ by 8 inches. The material is ¾ of an inch thick. The ends are dovetailed into the sides, the top and bottom being screwed on. Further directions are not deemed necessary as the methods of making and finishing mahogany cabinets are understood by many experimenters. If care is used in building a set of this type, compactness and efficiency will result.

A point in connection with the rotary

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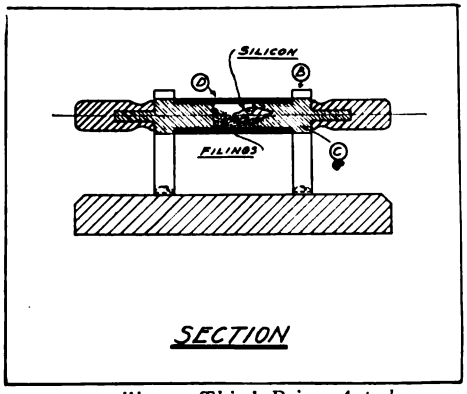


Fig. 1, Third Prize Article

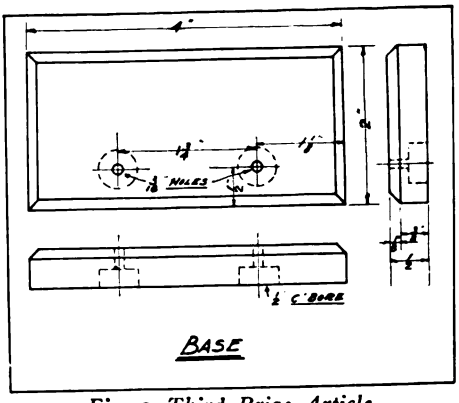


Fig. 2, Third Prize Article

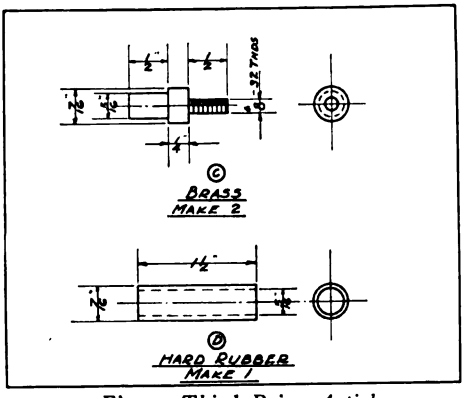


Fig. 3, Third Prize Article

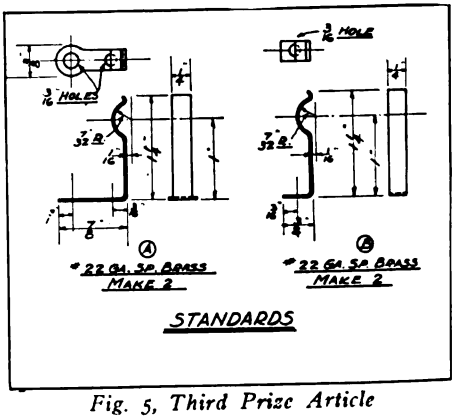


Fig. 5, Third Prize Article

gap that must not be overlooked is that the distance between the stationary electrodes and the movable electrodes must not be more than or of an inch which of course demands that the rotor have no end play.

A. E. HENNINGER, *Ohio.*

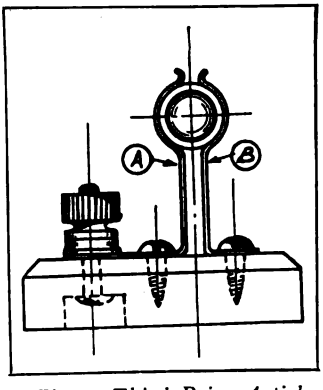


Fig. 4, Third Prize Article

## HONORARY MENTION
### An Aerial Which Can Be Erected on Top of a House or Barn

The majority of amateurs fasten one end of their aerial to a tree or pole and the other end to the peak or gable of the house. Keeping this fact in mind, I offer a suggestion in the accompanying drawings for a mast which can be erected on the top of a house or barn. The two main supports are built of 2 inches by 2 inches timber. For a mast to have a height of 30 feet, 6 pieces are required, each of which are 10 feet in length. The legs of the mast are spread apart at the bottom by an 8-foot piece of one-inch board, 3 inches in width at the top, nailed or bolted together.

An eye bolt is fastened where the two pieces join at the top to which is fastened the pulley for drawing up the aerial. Spaced by a distance of 10 feet, there should be nailed or bolted a cross piece and between two crosspieces two wires should be strung, as shown in the sketch. These wires may be drawn taut by small turnbuckles which may be secured at any supply house. Two guy wires should be fastened to the top and an additional two in the middle.

During the erection of the mast place

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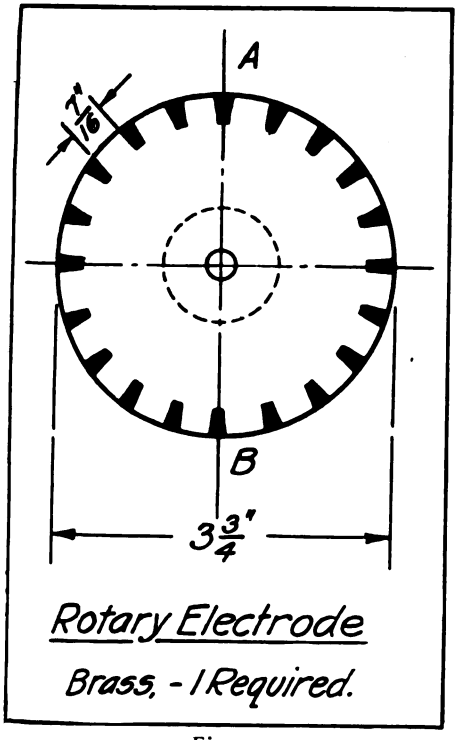


Fig. 1

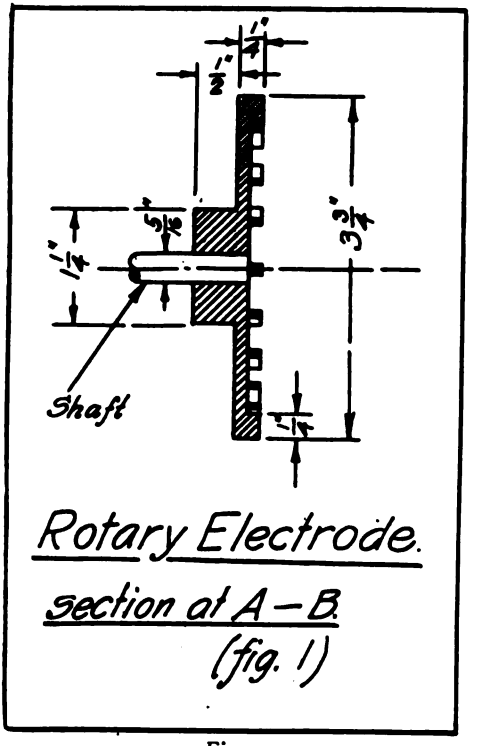


Fig. 2

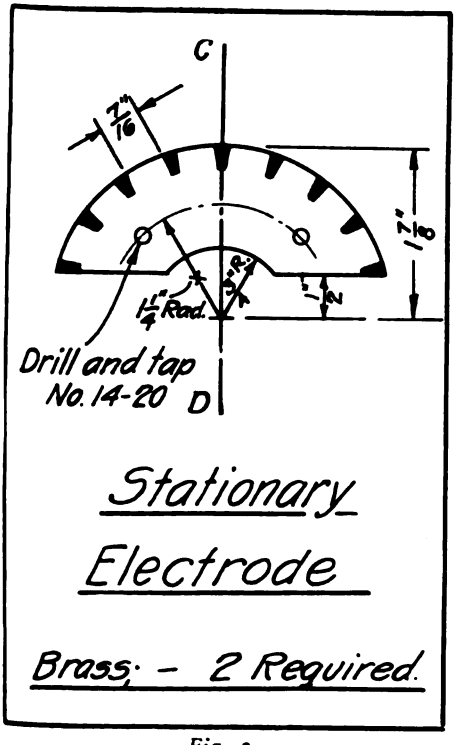


Fig. 3

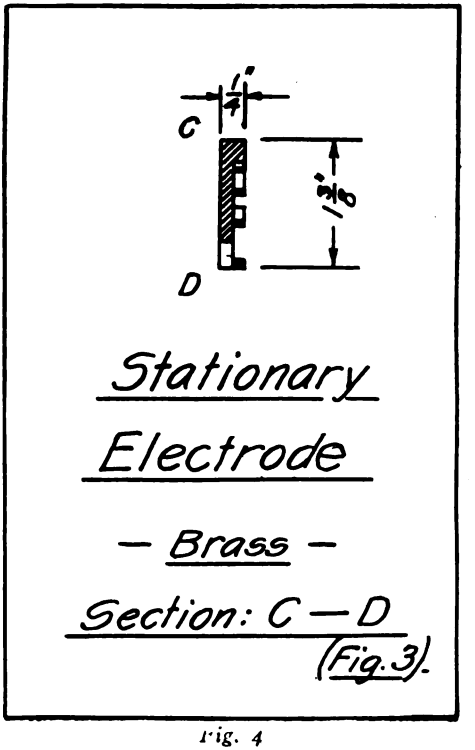


Fig. 4

Drawings, Fourth Prize Article

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two cleats on the roof upon which the legs will rest. Before erection be sure that the guy wires, block and tackle are in place. Erection will then be easy. Generally this may be accomplished with the assistance of two other enthusiasts in the neighborhood, who will be able to pull on the top guy wires while another holds the base in place. The guy wires

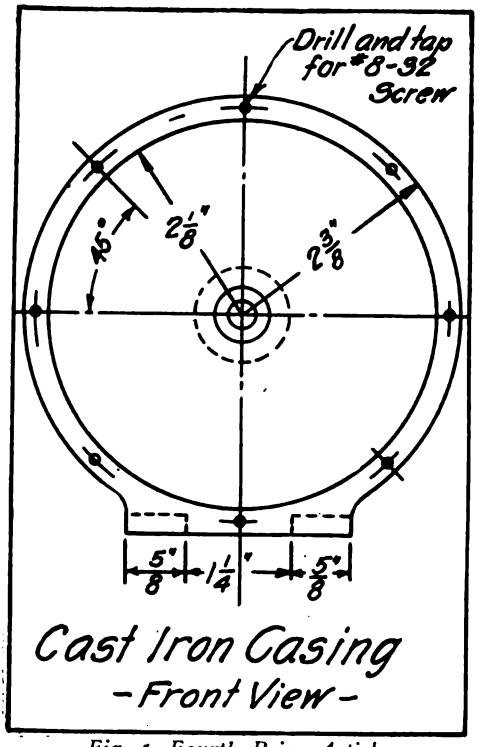


*Fig. 5, Fourth Prize Article*

may be insulated, as shown in the accompanying drawing, by means of small porcelain knobs.

The amateur who is not allowed to cut a hole in the roof to take a mast of the ordinary type of construction, will do well to construct an aerial support along these lines, as it is readily apparent that the roof will not be injured.

ALLAN LAWSON, *Connecticut*

## HONORARY MENTION

### Receiving Sets With and Without a Triple Vacuum Valve Amplifier

In answer to a query of S. M. P., of Johnstown, Ohio, appearing in the December issue of THE WIRELESS AGE, there is a statement to the effect that it is extremely difficult to construct a transmitting set, operating on a wave-length of 200 meters capable of transmitting 30 miles, unless a triple vacuum valve amplifier is used at the receiving station. At the time of this writing an amateur set thirty miles away is plainly readable and my telephones are four feet away on the operating table. I use a single vacuum valve bulb for receiving purposes.

There are many amateur stations located in various parts of the United States, the night range of which is in the neighborhood of 600 to 700 miles. My own sending record is 800 miles and I have no difficulty in exchanging messages in the early afternoon with stations 300 miles away. There are about half a dozen other experimenters in the city in which I live who have ranges as great, if

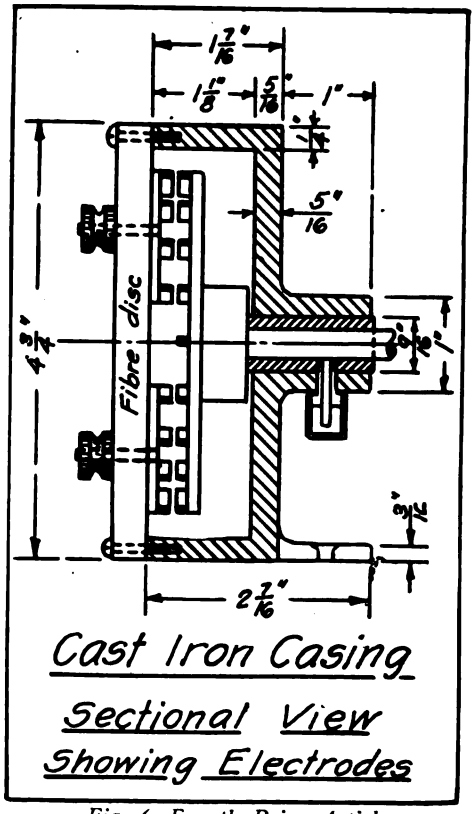


*Fig. 6, Fourth Prize Article*

not greater, than mine. Every evening we handle messages to and from stations in Ohio, Northern Wisconsin, Nebraska, Kansas, Missouri, Indiana, Michigan and, in a few cases, as far as Texas. I can read 9LO, located in Kansas City, with my phones six inches from the ears,

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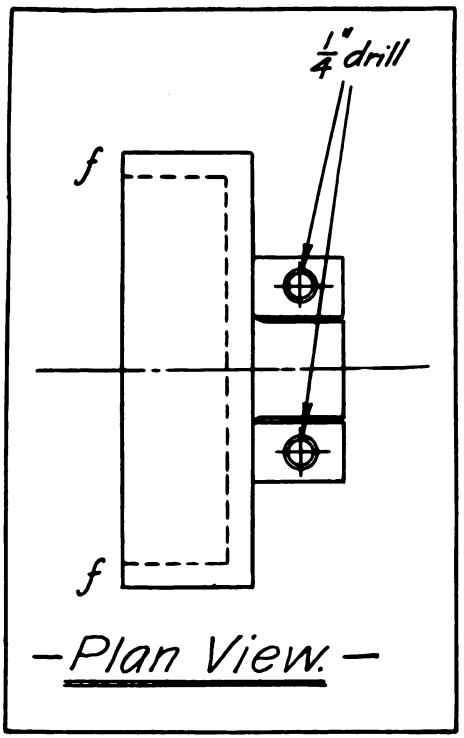


Fig. 7, Fourth Prize Article

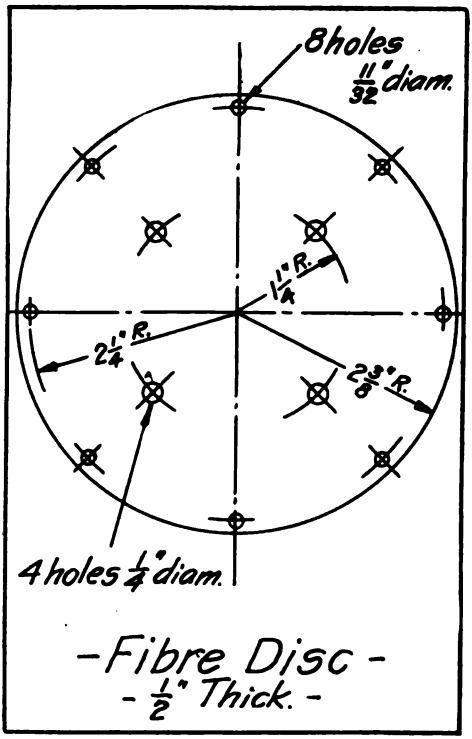


Fig. 8, Fourth Prize Article

and a friend of mine nearby hears this station almost as well on galena.

This is probably freak work, but I think it worth bringing to your attention.

R. H. E. MATHEWS,
*Illinois.*

EDITOR'S NOTE. — We are aware that the results obtained by our contributor are possible at night time and during the favorable months of the year, particularly in the district in which he resides. But after investigation it may be found that many of the stations to which he refers do not operate on wave-lengths of exactly 200 meters. Perhaps they use a close degree of coupling between the primary and secondary windings of the oscillation transformer and, in consequence, one of the emitted waves is greater than 200 meters and, therefore, may have better carrying qualities. In the eastern district of the United States distances of this order are only possible with increased wave-lengths and increased primary power. However, a station on Long Island communicates nightly with an amateur station somewhere in Ohio. We still insist that for satisfactory daylight communication under all conditions, particularly those imposed upon amateurs in the eastern part of the United States, a sensitive receiving set is necessary for a range of, say, thirty miles, when the transmitting set is operated at a wave-length of 200 meters. During the night, however, such transmitters may cover several hundred miles, as our contributor states. We shall be glad to hear from other amateurs in the Middle West who have obtained similar results.— TECHNICAL EDITOR.

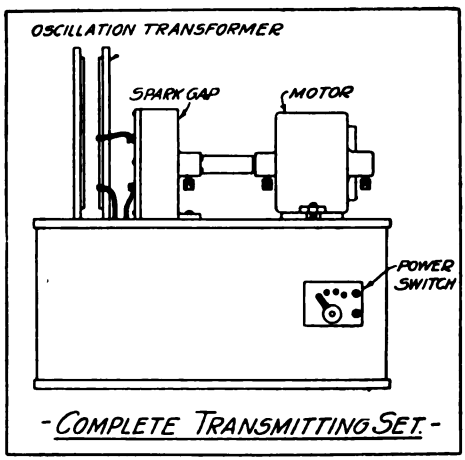


Fig. 9, Fourth Prize Article

## HONORARY MENTION

### A Telegraph Key Suitable for the Handling of Large Powers

A telegraph key suitable for the

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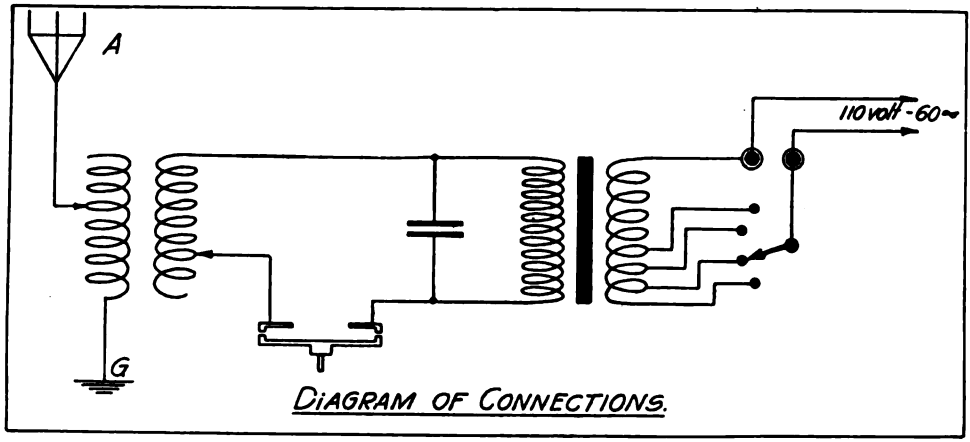


*Fig. 10, Fourth Prize Article*

handling of large powers such as are employed in radio telegraphic work, can be constructed by the experimenter in the following manner: Take an ordinary telegraph line, or wireless telegraph key, and remove the upper and lower contacts. Remove the conical spring and in place thereof, solder a piece of spring brass, C, to the lever. Connect the other end to one of the binding posts. The upper contact is made of a copper rod, D, of the correct length to just clear the bottom of the metal receptacle, A. It should be about ¼ of an inch in diameter. The metal receptacle is then connected to the second binding post.

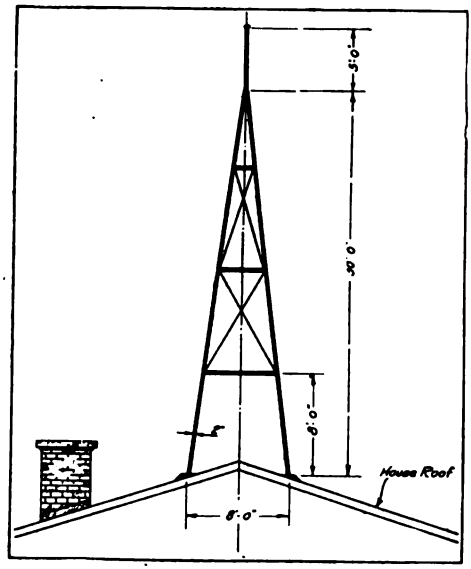


*Fig. 1, Honorary Mention Article, Allan Lawson*

Pour enough mercury in the metal receptacle to cover the bottom to a depth of ⅛ of an inch and over this pour a quantity of good transformer oil as at B. Regulate the set screws in the lever to give the correct amount of motion.

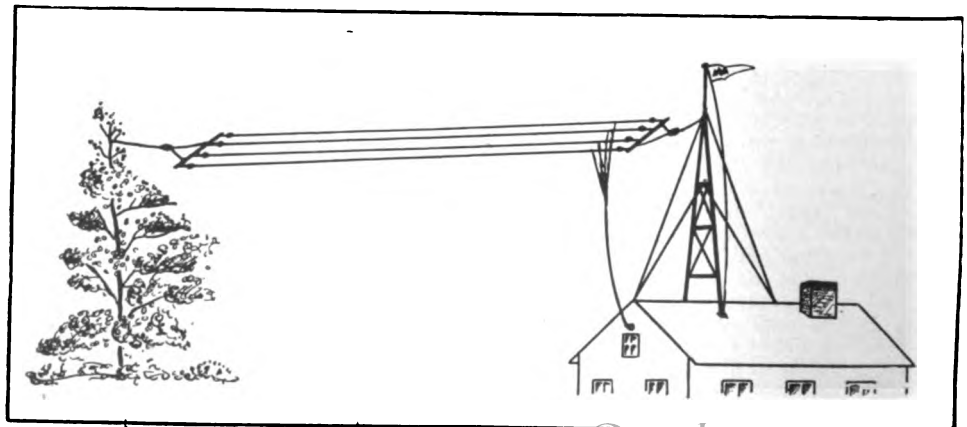

*Fig. 2, Honorary Mention Article, Allan Lawson*

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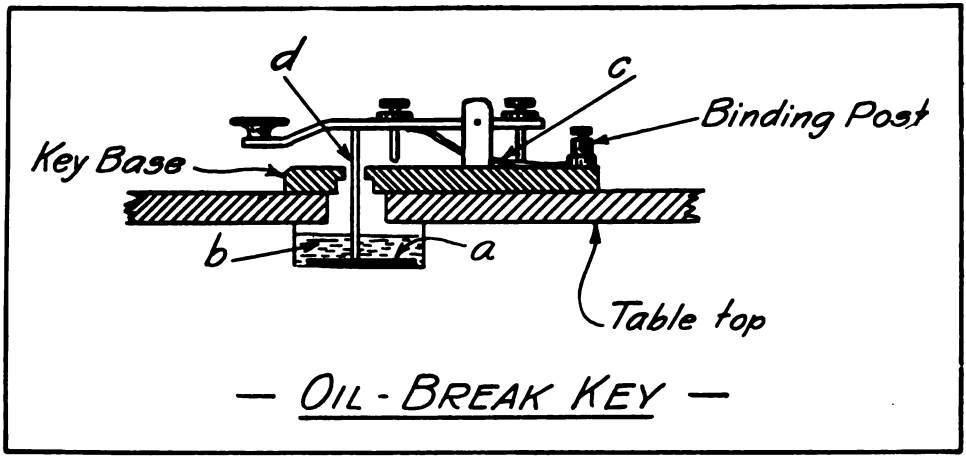


*Drawing, Honorary Mention Article, E. R. Thomas*

Properly constructed, this key will handle the current for a 1 k.w. transformer.

The device is an efficient substitute for the usual platinum point contacts which generally cost from $4 to $6 a pair.

E. R. THOMAS, *Pennsylvania.*

## NO DUTY ON WIRELESS

A customs dispute between Collector Malone and Kennedy & Moon, dealing with the entry of complete wireless apparatus installed on the government fleet of six Panama steamships, was settled in New York on January 12 by the Board of United States General Appraisers. A decision by Judge Hay held that no duty accrued on the outfits. Although the contracting firm complied with the regulations of the Treasury Department governing such importations, the Collector denied free entry, and took a 20 per cent duty under the tariff's provision for "manufactures in chief value of metal."

The Collector, at the trial before the board, stated that free entry was denied because the wireless apparatus was installed on old boats, and therefore, he maintained, excluded from the free privileges of the subsections of paragraph J of section 4 of the Underwood tariff law. The testimony showed that the new wireless outfits were imported and installed to take the place of other apparatus, which did not give good results.

Judge Hay held that the wireless equipment was as much covered by the tariff's exemption clause as were boilers and engines.

## BILL ASKS FOR GALVESTON STATION

A $50,000 appropriation for a medium power wireless station at Galveston, Texas, was asked in a bill offered by Senator Morris Sheppard on December 16. The equipment asked for would be capable of sending messages from 800 to 1,000 miles. Another bill calling for a similar amount provided for two new weather stations on the Gulf coast west of New Orleans to assist the weather bureau and send out storm warnings to shipping in the Gulf.

Residents of Galveston have pointed out that such a plant would be of great service when heavy storms had cut off communication with the main land. It would also be of service to shipping and a strategic value to the government. There is already a high-power station at Brownsville.

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# A High-Power Plant for Research Work

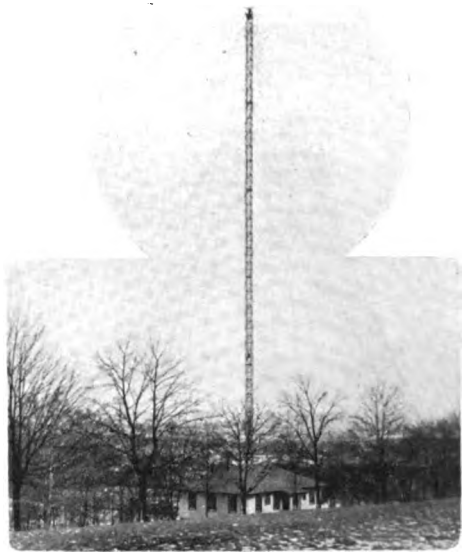
### Striking Features of the New Tufts Station

A HIGH-POWER wireless station has recently been installed and placed in operation at Tufts College, Medford, Mass. A noteworthy feature of the station is the great skeleton steel mast, 304 feet in height, imbedded in solid concrete. The tower can be seen for miles, its slender black framework, only three feet six inches square at the base, silhouetted against the sky.

Supported on four specially designed porcelain insulators, which are imbedded in fifteen tons of reinforced concrete, it is constructed of twelve-foot sections of structural steel, and is held in position by twelve heavy crucible steel guy wires, one inch in diameter, secured at different heights and imbedded in their bases in blocks of concrete. The tower is topped by a large antenna from which ten fine wires conduct the electric current to the laboratory below. The mast is described as the highest wireless tower in New England.

A few feet from the tower stands the laboratory, which is built of concrete. To the casual observer this solid looking structure has little significance. In it, however, are a complete outfit of wireless apparatus, machinery and tools of the latest design, testing instruments of a very delicate kind and a perfect set of machinery for experimental use.

It is believed by wireless men that no advantage is gained by placing a wireless station on the top of a hill rather than at sea level. The Hertzian waves follow the contour of the earth and often a better earth connection is obtained at sea level. This is due to the damp soil, where there is more efficient electrical ground. In the case of a hill there is usually excess of drainage; the soil is dry and is therefore not a good electrical conductor. The Tufts station is ninety-six feet above sea level and near the bottom of the hill, but high enough to overcome local obstruction of the waves, such as houses and trees. At the same time it receives the drainage of the hill and the soil is damp all the year.



*The tower, 304 feet in height, can be seen for miles, its slender framework silhouetted against the sky*

The interior of the laboratory building is finished in smooth white stucco, trimmed with dark green lattice work. The building is practically sound and vibration-proof, allowing the use of the most delicate instruments, a very important factor of the research work now being carried on. Each room was tested with a microphone.

A large assortment of the latest design testing meters is to be found in the laboratory. These instruments are so delicate that the minute current produced by placing the fingers on the contact buttons is recorded. The floors are all double and lined with heavy layers of felt. The doors are



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double sound-proof. The Tufts Wireless Society will have a room in the building and eventually the plant will revert to Tufts College. Harold J. Power, manager of the Atlantic Radio and Research Corporation, which established the plant, has a specially designed laboratory for his own use. The station will not be used for commercial work. It was designed solely for research.

The equipment of the machine shop is so complete that it is possible to turn out practically anything from a watch spring to an automobile engine.

*This photograph shows the interior of the laboratory which contains a complete equipment of wireless apparatus, machinery and tools of the latest design and delicate testing instruments*

All of the machinery is of recent design. It is equipped with modern safety appliances, among the metal working machines being several of the latest type upright drills, shapers, jewelers' lathes and delicate hand tools of various descriptions.

Mr. Power is a graduate of Tufts and erstwhile operator on various steamships on the Atlantic. Following his graduation he took a course in laboratory research at Harvard. When this was completed he organized the Atlantic Radio and Research Corporation. He decided to locate the wireless plant at Tufts because of the advantages of the site and its proximity to the laboratories of other educational institutions in and near Boston.

Mr. Power began wireless experimental work when the art was first being used in a commercial way. Some time after the results of Mr. Marconi's experiment had become known, young Power managed to construct a crude transmitting and receiving set. His "laboratory" consisted of a shack in the rear of his home. He did not foresee then that twelve years later he would be able to copy a wireless message from Germany as he did recently in the Tufts station.

He undertook his first commercial work when he was sixteen years old. Next he entered the Marconi service,

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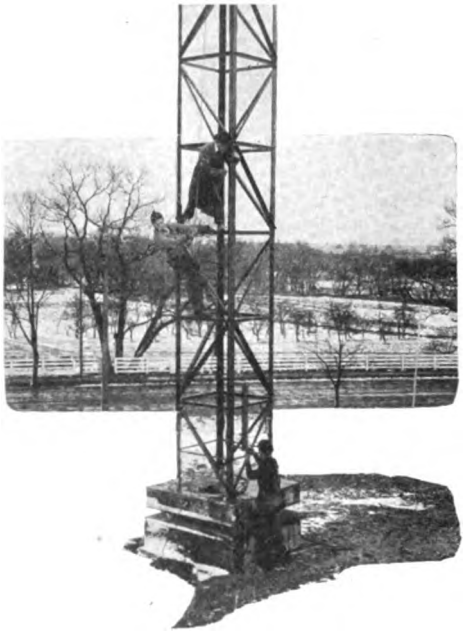

*The Tufts tower is supported on four specially designed porcelain insulators which are imbedded in fifteen tons of reinforced concrete*

being detailed as wireless operator on the Metropolitan line. As he gained experience he was placed in posts of greater responsibility. He was detailed on vessels of the Savannah Line, the Red Cross Line and Colonel John Jacob Actor's yacht, the Noma. He also served on the St. Louis of the American Line and on J. P. Morgan's yacht, the Corsair.

He began to devote his energies to the solution of radio problems in his senior year at Tufts, when he made a complete mathematical analysis of all the highest types of standard receivers and designed a new receiver embodying the principle evolved as a result of his work.

Associated with Mr. Power in the management of the Tufts station are his brother, John F. Power, chief mechanic; Eugene F. Randall, chief laboratory assistant; Harry R. Cheetham, formerly construction engineer for the Marconi Company, who has charge of the tower and antenna, and a number of electrical engineers.

## NAVAL CHAIN PLAN RATIFIED

One of the final steps toward linking the United States and its foreign possessions together by a great chain of wireless stations was taken on January 19, when Secretary Daniels of the Navy approved the equipment of the stations now under construction at San Diego, Cal.; Cavite, Philippine Islands, and Pearl Harbor, Hawaii.

Completion of these stations within the next year will pave the way for radio communication from Washington to the insular possessions.

Plans now are being prepared by the Navy Department to increase the power of the existing equipment at Tutuila and Guam so as to make them a part of the main world chain. The intermediate stations at Boston, New Orleans, Point Loma, Chicago, and Guantanamo, Cuba, already have been strengthened and are able to relay messages from ships at sea to Washington via the Arlington, Va., towers.

The new stations at Pearl Harbor and Cavite will be equipped to maintain direct communication with San Diego, the Canal Zone, and the Arlington stations, and be able to sweep the Pacific Ocean from the Philippine Islands to Alaska and the Canal Zone.

*At work in the Tufts laboratory. The building is practically sound and vibration-proof, the room having been tested with a microphone*

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## MARCONI MEN REWARDED

The valuation of faithful service which the Marconi Company places upon noteworthy acts among employees is revealed in the sequel to the reports of exceptional work done in the recent Gulf storms.

In a letter to J. A. Pohl, the newly appointed superintendent of the Gulf Division, Traffic Manager George S. De Sousa highly commended the faithful manner in which Mr. Pohl attended to his work and added "It has confirmed the opinion which I have of you—that you are always to be depended upon in any emergency." In further recognition, a substantial Christmas present, authorized by the General Manager, was added. A letter similar in spirit was addressed to J. W. B. Foley, Manager of the Port Arthur (Texas) Station and also accompanied by a special Christmas gift.

In acknowledging the special distinction, Mr. Pohl said: "I am so very glad to know that my services rendered during the Texas hurricane have pleased you. I assure you that my efforts will be in the future as they have been in the past, to do everything possible for the good and welfare of our company. I am very proud of the letter you have written me and consider it my most valued keepsake."

Mr. Foley replied: "On Christmas Eve I was very much surprised, and pleased also, when I received your gift and beautiful letter, which I consider of inestimable value. Words cannot express my feeling of appreciation toward you and the other gentlemen who caused such to come to pass. That letter has inspired a faith in me toward the Marconi Company which I never had for any of my former employers. It simply goes to show that which I have heard, namely—that the Marconi Company has an interest in its employees, keeps itself informed of their actions, and takes proper care of the deserving."

## MARCONI COMPANY OBTAINS INFRINGEMENT INJUNCTION

The Marconi Wireless Telegraph Company of America recently brought an action against the American-Hawaiian Steamship Company for infringement of its well-known "tuning patent," which has been the subject of extensive litigation and the use of which by the National Electric Signaling Company, Deforest Radio Telegraph Company, Standard Oil Company, Atlantic Communication Company and others, has been enjoined by the courts. In this suit against the American-Hawaiian Company the Marconi Company obtained an order from Judge Veeder, sitting in the Eastern District of New York, to show cause why a preliminary injunction should not be granted enjoining the American-Hawaiian Steamship Company from continuing the use of certain wireless telegraph apparatus made by the Kilbourne & Clark Manufacturing Company, of Seattle, Washington, and which had been installed on the American-Hawaiian steamship Floridan. Judge Veeder, holding court in Brooklyn, on January 8, entered an order granting the preliminary injunction asked for by the Marconi Wireless Telegraph Company of America and enjoined the further use by the American-Hawaiian Steamship Company of the Kilbourne & Clark apparatus on the steamship Floridian. In order to allow the steamship company an opportunity to replace the Kilbourne & Clark infringing apparatus with non-infringing apparatus, he suspended the operation of the injunction for thirty days.

## STORM DROPS SAYVILLE ANTENNA

The German station at Sayville, L. I., now operated by United States naval operators, was out of commisison on December 29, on account of the Atlantic Coast storm. Heavy sleet and high winds brought down the antenna, but it was announced that the receiving apparatus was not interfered with.

The station was repaired and in operation the next day.

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# The Shelling of the Petrolite

## An Operator's Dramatic Recital of What It Means to Be Under Fire By a Submarine

**By J. G. Woltal.**

TO watch the thin smoke cloud dissolve before the mouth of a cannon; to listen to the crescendo shriek of the oncoming projectile; then to feel the deck leap under your feet when it explodes—this in a few words tells the story of what it means to be under fire by a submarine. My impressions thus summarized were gained when the Standard Oil tanker Petrolite was attacked by an Austrian underwater craft in the Mediterranean.

*Operator Woltal, who received lasting impressions of the attack by the underwater craft*

Laden with a cargo of oil, the Petrolite, on which I was detailed as Marconi wireless operator, steamed out of New York Harbor on November 7, bound for Alexandria in faraway Egypt. All the way to Gibraltar the steamship wallowed heavily through the green seas and it did not make a stormy voyage any pleasanter to pick up Poldhu calls describing submarine raids along our prospective course. We made Alexandria, however, without accident, discharged our cargo under the guard of police armed with rifles and began the voyage back to New York.

I picked up the Communipaw on the evening of December 4 and was told that the vessel had been chased twenty-five miles by a U-boat, which had just torpedoed an unidentified tramp. As the Communipaw suggested that the survivors were probably still adrift, we altered our course to search for them. No one slept well that night, for none could say what the next day would bring. I, at least, tried on a good life belt and hung it up behind the door of the wireless room. Another I placed near my bunk.

It was 2 o'clock in the morning before I fell asleep and it seemed to me that my eyes had been closed only a short time when there came a cash that made the cabin shake. Hurled out of my berth, I landed in the middle of the floor. Then I jumped to my feet, grabbed one of the life belts and made my way out on deck.

Dawn was just breaking and a light wind ruffled the sea. Our engines had stopped and the vessel was swinging in a wide half-circle, displaying our broadside with "Petrolite of New York, U. S. A.," painted on the black hull. And a short distance to windward was a long, light gray submarine with her conning tower showing in the early



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light. By using a pair of binoculars I could see a man whom I assumed to be her captain, standing on the bridge, while on the deck below were half a dozen white-clad figures grouped around the breech of an ugly-looking rifle. I noticed that the broad black muzzle was covering the pit of my stomach.

Even as I watched, a puff of thin bluish smoke hid the gun and a sound like the squealing of the brakes on a street car was borne to us by the wind. Then the deck jumped under my feet and I realized that a shell had burst. There followed the report and out of our ventilators drifted some fumes with a sharp, acrid stench.

I could hear the crew shouting and coughing as they tumbled up from below and made for the boats. Officers checked the rush and I noticed that several had revolver butts showing out of their hip pockets, but there was no panic. Some of the firemen were ordered below to get extra clothes, and as our boats had been swung out, tested and provisioned when we entered the danger zone, nothing remained but to lower away.

Meanwhile the submarine kept on firing. A shell burst on the fidley, breaking it in two places, denting it out of shape and sending the rivet heads flying. The funnel uptake was riddled and the whistle pipe cut, as a result of which the decks reeked with a mixture of smoke, gas and hot steam. The men were swearing and choking and one stoker was cut in the thigh by a three-inch strip of jagged shell case.

The captain had gone overside in a small boat and was pulling out to meet the submarine, which forged slowly toward us. We could make out the Austrian ensign at her stern and saw that she was about 250 feet long. To me she looked like a big gray shark with one fin standing up out of the sea. I got the glasses again and watched our captain's boat as it pulled alongside. The captain stood up in the stern and the commander of the submarine leaned over the wire bridge rail of the conning tower. Presently one of our crew got out on the deck of the submarine, the captain sat down and the boat pulled back.

He was very red in the face when he reached the Petrolite and went into the wheel house with the first officer. We gathered from the boat's crew that the commander of the submarine was holding one of our men as hostage for a supply of provisions. He said that we had been attacked because our vessel appeared to be a big cruiser.

As there was no alternative except to yield to the Austrian's demand, our captain sent a quantity of canned goods and condensed milk to the underwater craft. Five minutes later the U-boat had sunk below the surface of the water and happily, according to my viewpoint, we saw her no more.

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## QUARANTINED FAMILY BUYS BY WIRELESS

A wireless telegraph apparatus kept the family of Charles Morton, of Edwardsville, Mo., in communication with the world during a period of quarantine.

The illness of Morton's son, with smallpox, caused the family to be isolated by order of the board of health authorities. A wireless set was installed on the Morton premises, and another at the home of Andrew Vogel, on the other side of town. As the Mortons have no telephone, they have been signaling their orders for groceries and other necessaries to the obliging Vogel, who sees that the orders are transmitted to their destination.

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## BRITISH EMBARGO BARS APPARATUS

The American Consul General, at London, has notified the State Department of a change in the British export embargo by which wireless telegraph apparatus is prohibited to all countries in Europe, excepting the British possessions.

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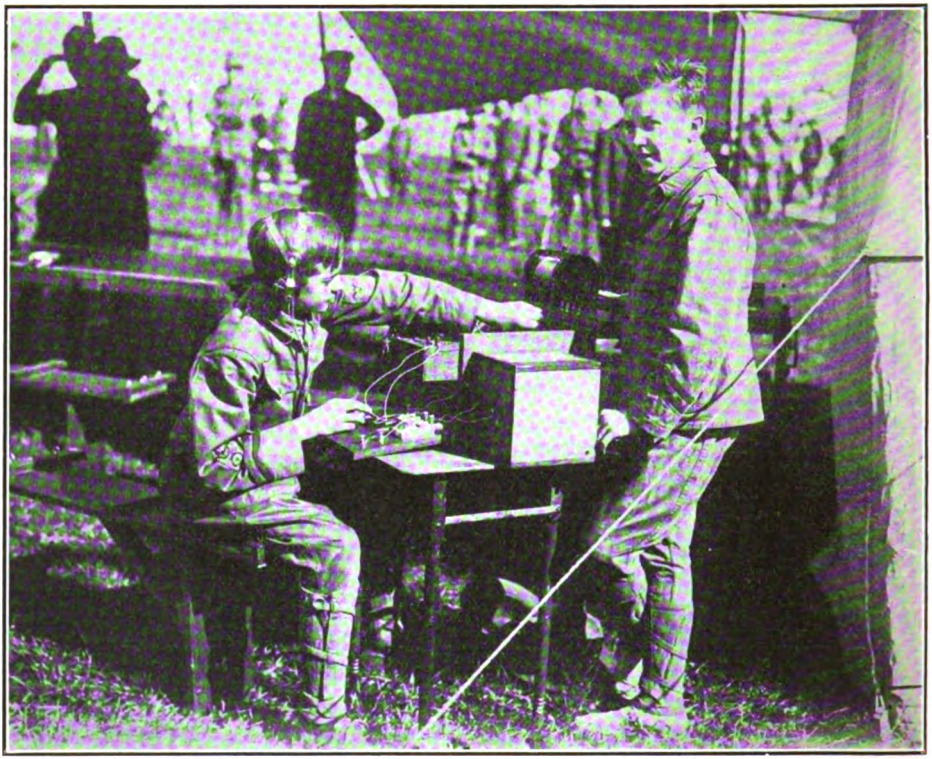
# With the Amateurs



*Roland Cosgrove and Bruce Clark operating a wireless set at the Boston Boy Scout rally*

As the New Year dawned the ether above the United States was a-tremor with wireless activity incidental to the relaying of a wireless message of good cheer and wishes for happiness in 1916 through the length and breadth of the land. The message originated at midnight in Davenport, Iowa, where it was sent forth from Station 9XE by W. H. Kirwan. Its destination was Washington, D. C., and the principal cities throughout the country. It was designed for delivery to President Wilson and the city officials of each city where it was received.

It was necessary, because of the restriction in the amount of power employed in private radio stations, to relay the message many times.

John B. Berger, president of the Rotary Club of Baltimore, received New Year's greetings from Oswald Becker, president of the Rotary Club in Davenport. The message was sent by Mr. Kirwan and received by C. R. Lamdin, who immediately communicated the dispatch to Mr. Berger. It read as follows: "A happy New Year to you and the members of your club. May the new year be full of love, laughter and song."

The same greetings were extended to the presidents of all the Rotary Clubs in the larger cities of the United States. At Washington, George W. Harris, president of the club there, delivered a copy of the message to Joseph P. Tumulty, secretary to Presi-



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dent Wilson, who sent it to the head of the nation.

In order that the message might not be lost, all owners of stations, except those who were to receive it, had been requested, via wireless, by Captain W. H. G. Bullard, superintendent of the United States Naval Radio Service, not to use their apparatus after 9.30 P. M., Central time, or 10.30 P. M., Eastern time.

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A practical test of the reliability of amateur wireless stations in time of war was made, when New Year's greetings were relayed from coast to coast by amateurs under the supervision of the Naval Radio Service.

For the period between the close of the sending of the regular night reports from Arlington and midnight, a space of about two hours, the United States was supposed to be in a state of war, with the high-powered government stations put out of business by the enemy, land telegraph lines cut or in the hands of the invaders, and the amateur stations the only means of communication left. Important messages had to be transmitted to commanders of various army and navy forces at widely separated parts of the country and these messages were handled by the amateurs.

Certain amateurs, the chain extending from coast to coast, were designated by the Naval Radio Service to handle the messages and the outcome of the test was closely watched by the naval officers in order to ascertain the real abilities of amateurs to serve the country in time of national peril.

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The amateur operator who attempts to make use of the air for his own purposes soon discovers that the passage way for his messages are much more occupied than he suspected, because the recognized government official and the amateur himself and their thousands of associates are all using the air to such an extent that at times chaos reigns supreme. In the belief that the amateur might find relief in study, a radio club has been formed at the Boston Young Men's Christian Union.

The seventeen wireless enthusiasts, who have banded together for mutual purposes, have interested Professor A. E. Kennelly of Harvard, who is a practical wireless operator. At the head of the club is Edward A. Gisbourne. He was a signalman and wireless operator in the United States Navy until wounded at Vera Cruz, spending four years in the service. Under the guidance of these two men, the members of the club expect to learn more about the wireless than has yet come to their knowledge.

Books will not form a great part of the work of the club, except in so far as the members use them individually. One feature will be competent instruction in bench work, which will be carried out at the weekly sessions. All in all, the members are taking their new club as a co-operative affair in which they hope to give as well as receive.

The Radio Club is also enlarging its apparatus by the installation of an aerial having a wide receiving radius, a sending apparatus limited to the legal requirements of 500 miles, and the construction of a new receiving station. Arrangements have been made so that the apparatus needed by the club will be made in that institution.

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Miss Aline Mengelkoch of Minneapolis, after a four months' course at the American Telegraph College, took the examination for the government radio service and was one of five out of a class of thirty to pass. All of the other candidates were men. Miss Mengelkoch is now eligible for any position in the service of the Navy Department's wireless division except that which will give her charge of a ship station.

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The Radio Club of America has announced the election of the following officers for the year 1916: President, Edwin H. Armstrong; vice-president, T. Johnson, Jr.; treasurer, Ernest V. Amy; corresponding secretary, David S. Brown; recording secretary, Thomas J. Styles; directors, Paul F. Godley, Alfred P. Morgan, Harry Sadenwater, Joseph A. Fried and Walter S. Lemon.

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The Atlanta Radio Club, organized a little more than a year ago for the purpose of advancing the amateur interests in Atlanta and vicinity, has received many congratulations on the booth and exhibit which was their share of the large electrical Show held in Atlanta during the National Electrical Prosperity Week.

One of the interesting features of the exhibit was a replica of the first Marconi set, complete with induction coil and coherer. Near this was a complete sending and receiving set of modern type, owned by members of the club, with which messages were received and transmitted. Visitors listened to popular lectures by members of the club on the theory and practice of wireless telegraphy.

The show was held on the ground floor of a large office building, upon the roof of which was erected an aerial, the height of which was almost 200 feet. Its length was 400 feet. Another point of interest was a table covered with sending and receiving sets constructed by members of the club.

Recently adopted rules save considerable interference and loss of time and make interchange of conversation much more pleasant. The club has a special operator who sends out official notices to all members on a certain day and hour and also has an inspector of stations whose duty it is to adjust each station so that it will cause a minimum of interference. The latter also sees that each station conforms to the government radio regulations regarding wave-length, power, etc.

The majority of the members possess amateur licenses and will try for higher licenses at the first opportunity.

*The Atlanta Radio Club Exhibit at the Electrical Prosperity Week Show*

The Atlanta Radio Club will be glad to hear from similar organizations or from anyone interested in wireless. Letters should be addressed to the secretary, M. A. Herzog, No. 16 Faith Avenue, Atlanta, Ga. Officers of the club are: President, Francis Merriam; vice-president, R. A. De Vore; secretary, M. A. Herzog; treasurer, B. Magee.

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The New Britain Radio Club of New Britain, Conn., held a meeting on De-

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cember 28 at which President Mulvihill presided. To eliminate local interference it was voted that members should devote the time from 7 to 7.15 P. M. to their personal calls, and that M O should be the general call.

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With a membership of twenty the Wildwood Radio Association of Wildwood, N. J., was organized on January 7. Ten at least of the members have installed private wireless stations of considerable power, and one big central spar is expected to carry over a radius of 300 miles. The association will become affiliated with the Wildwood Rifle Club and be ready for service in the proposed Continental army.

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The Eastern Radio Relay has announced the election of the following officers: Executive secretary, J. F. Diehl, New York City; division secretaries, M. V. Bryant, Nyack, N. Y.; C. Benjamin, Clyde, N. Y.; J. D. Platt, Weehawken, N. J.; district secretaries, George Meder, New York City; E. French, Peekskill, N. Y.; E. Heermance, Hudson, N. Y.; A. Dodds, Albany, N. Y.; and A. E. Newton, Jamestown, N. Y.

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Students interested in wireless telegraphy at Phillips Academy, Andover, Mass., have organized a wireless club, under the direction of Harold S. Wilkins. The purpose of the club is to promote interest in wireless telegraphy and to provide the members an opportunity to perform interesting experiments. The trustees have promised to install an aerial very shortly, and Donald Kitchin, P. A., '15, has already donated a ½-kw. transformer. A room in the basement of Graves Hall has been reserved for the club.

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The Austin Radio Club of Austin, Texas, has been organized with the following officers: President, D. Harrell, Jr.; secretary and treasurer, A. E. Hancock. Meetings are held once a month.

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The Topeka (Kas.) Radio Club announces the election of the following officers: President, R. K. Trump; vice-president, I. H. Waugh; secretary and treasurer, R. L. Morehouse; sergeant-at-arms, V. Van Hook. All correspondence should be addressed to Raymond L. Morehouse, Highland Park, Topeka, Kas.

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Wireless telegraphy gained so much popularity in Waterloo, Ia., during the past year that not only several groups of amateurs constructed stations, but a radio club was organized by the students at the West High School, for the purpose of taking up the subject of long distance communication by wireless. The officers of the new club are: President, Harry N. Royce; vice-president, Harold La Rue; secretary and treasurer, Karl von Lackum. An aerial was erected on the high school grounds.

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Twenty-five members of the East Side Branch of the New York Y. M. C. A. have enrolled in the Wireless Reserve Corps of the United States Army. One hundred members of this branch have organized a company for military training.

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The Central Branch of the Brooklyn Y. M. C. A. has installed one of the most complete wireless stations in New York City. At the recent opening of their million dollar building, visitors were able to receive and dispatch messages, which were picked up at other branches and delivered by Boy Scouts.

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Regular scout bulletins are being sent out on Tuesday and Saturday evenings at 7 o'clock by the Hoosier Radio Club of Indianapolis. Scout Byron Elliott, a member of troop 18, is the official sender of the messages.

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Wireless amateurs "listening in" on the tests conducted by A. F. Van Dyke at the Carnegie Institute of Technology at Pittsburgh on the night of December 21, heard talking, whistling and singing. Amateurs within a ten-mile radius were notified when these tele phone tests were to take place.

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**Vessels Recently Equipped With Marconi Apparatus**

| Names | Owners | Call Letters |
|---|---|---|
| Amazonia | R. Lawrence Smith, Inc. | Koo |
| Santa Barbara | W. R. Grace & Co. | WBJ |
| Canastota | U. S. & Australasia SS. Co. | YSO |
| Catania | Haustica Petroleum Co. | WTI |
| Ardmore | Standard Oil Co. of New Jersey. | KIA |
| Healdton | Standard Oil Co. of New Jersey. | KOF |
| Henry Williams | Vacuum Oil Co. | KRL |
| Gargoyle | Vacuum Oil Co. | KRK |
| Diana, (S. Y.) | C. Ledyard Blair. | KZM |
| Souchan | Russian Volunteer Fleet. | RVS |
| Dade | Miami Steamship Co. | KXU |

## THE SHARE MARKET

NEW YORK, January 20.

All Marconi shares have shown gains during the past month. English, common, and English preferred, although closely held, have made remarkable advances. After two months of lethargy, the American Marconi stock has shown considerable activity with good net gains.

Bid and asked prices today:

American, 4⅛-4⅜; Canadian, 1⅜-1¾; English, preferred, 8¾-13½; English, common, 9¼-14.

## ENGLISH MARCONI DIVIDENDS

Announcement has been made by the directors of the English Marconi Company that they have not yet been able to obtain from British Government departments a basis of settlement in regard to either remuneration or compensation for services rendered, for the use of their stations since the commencement of the European war, nor in respect to other matters in which the government is indebted to the company. However, without taking into account the considerable sums which are estimated to be due to the company in respect of these matters, the business which has been actually completed for the current year has been satisfactory, and the directors, without departing from the policy, which was approved at the last general meeting, of husbanding their resources, feel justified in declaring the seven per cent preferential dividend upon the cumulative participating preference shares, and an interim dividend of five per cent on the ordinary shares.

At a meeting of the directors it was therefore resolved that a dividend of seven per cent, less income tax, upon the 250,000 seven per cent cumulative participating preference shares, numbered 5,001 to 750,000, be declared on account of the current year; that an interim dividend of five per cent, less income tax, upon the 1,222,688 ordinary shares, numbered 1 to 500,000 and 750,001 to 1,472,688, be declared on account of the current year.

## MARCONI SUES ANOTHER INFRINGER

Suit charging the Detroit & Cleveland Navigation Co. with infringement of a patent on its wireless apparatus has been filed by the Marconi Wireless Telegraph Co., in the United States Court, at Buffalo. A permanent injunction restraining the steamboat company from using the apparatus is asked. An accounting of the profits and damages are also asked.

Five steamers of the fleet are equipped with wireless apparatus furnished by the Kilbourne & Clark Co., of Seattle, Wash. The other vessels carry Marconi wireless. Restraining orders have been issued against the Atlantic Communication Co., the DeForest Radio Telegraph & Telephone Co., the American Hawaiian Steamship Co., and the Standard Oil Co. in similar suits.

## NEW PLANT AT CAPE MAY

The contract has been awarded for the new building for the Marconi Wireless Telegraph Company, at Cape May, N. J.

Erection of a tower 140 feet high will be started immediately.

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# Conference on Sealing and Inspecting Apparatus

## Methods Determined for Carrying Out Secretary of the Navy's Instructions Enforcing the Provisions of the Neutrality Proclamation Issued by the President

A CONFERENCE was held in New York on January 12 at the Custom House between Collector Dudley Field Malone, Lieutenants Bradford Barnette, U. S. N., and T. H. Taylor, U. S. N., representing Rear Admiral Nathaniel R. Usher, U. S. N., Commandant of the New York Navy Yard and Supervisor of the Third Naval District, and the chief radio inspector at this port, with regard to the enforcement of the President's neutrality proclamation so far as it concerns radio sealing and inspection.

The conference was arranged for the purpose of determining upon methods for carrying out the instructions recently issued by Secretary of the Navy Daniels, which provide for the necessary co-operation between the officers of the different forces upon whom devolve the duty of the enforcement of the provisions of the neutrality proclamation.

The instructions of Secretary Daniels follow:

All merchant vessels flying the flag of a belligerent country shall, upon entering United States ports, comply with the following rules:

1. Lower antenna of radio installation to deck and disconnect it from the radio station of the ship.

2. The receiving and transmitting apparatus shall be sealed by an officer of the United States.

3. The antenna shall remain lowered and disconnected and the apparatus remain sealed during the time the vessel remains within the limits of the port, unless repairs to such apparatus are necessary, the necessity and extent of such repairs being made known to the naval official immediately charged with the inspection, so far as relates to neutrality requirements, of the vessel's radio apparatus.

4. Permission to hoist and connect the antenna and to break the seals necessary to have the radio installation in operating condition on clearing the limits of the port must be obtained from the Collector of the Port.

William G. McAdoo, Secretary of the Treasury, has issued instructions to collectors of customs that a copy of the radio regulations be delivered to the master of each incoming belligerent merchant vessel. Collectors have been requested to notify the local naval commandant or designated naval officer of the arrival of each such vessel.

The supervisor of the naval district in which the port is located will inform the collector of the name and address of the naval officer to whom the notification of arrival of a belligerent merchant vessel shall be sent. Immediately before clearing, collectors will authorize the masters of such vessels to hoist the antenna and place the radio apparatus in condition for operation, so that on getting clear of the limits of the port the radio set may be available for its designed purpose.

Following are the naval districts, their limits and the headquarters of each:

1—Eastport, Me., to include Chatham, Mass.; Boston.



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2—Chatham, to include New London, Conn.; Naval Station, Narragansett Bay.

3—New London, to include Barnegat, N. J.; New York.

4—Barnegat, to include Assateague, Va.; Philadelphia.

5—Assateague, to include New River Inlet, N. C.; Norfolk.

6—New River Inlet, to include St. Johns River, Fla.; Charleston.

7—St. Johns River, to include Tampa, Fla.; Key West.

8—Tampa, to include Rio Grande; New Orleans.

12—Southern boundary to latitude 42 deg. north; San Francisco.

13—Latitude 42 deg. north to northern boundary; Port Townsend.

## AEROPLANE EQUIPMENT FOR NATIONAL DEFENSE

"A continuous picket line of seaplanes, fifty miles or more off shore and 2,000 feet or more in the air, around our entire coasts from Eastport, Me., to Brownsville, Tex., and from San Diego, Cal., to Cape Flattery, Wash., each machine traveling back and forth—back and forth—over its section or 'beat!'"

Thus Rear Admiral Robert E. Peary, retired, discoverer of the North Pole, spoke of the plan for an aeroplane coast patrol at the tenth annual banquet of the Aero Club of America.

After describing the advantages of the aeroplane as a natural and valuable adjunct of the coast guard and life-saving service, Admiral Peary proceeded to the subject of war

"In war times the patrol could weave such a continuous off-shore curtain of observance around our entire coasts as would make a surprise attack in force an impossibility.

Admiral Peary recounted how at night, or in a fog, the sentinels would send in by wireless the signal that would bring out a flock of battleplanes with a cargo of bombs. It might be possible to send out a fleet, according to experts, of such power that it could completely destroy or cripple hostile battleships.

## AERO-WIRELESS TORPEDO CONTROL

Wireless control from an aeroplane of a coast defence torpedo has been developed, the patents for which are included in the Hammond radio-controlled torpedo rights, for the purchase of which the Navy Department has asked Congress to appropriate nearly a million dollars.

Aeroplane control makes it possible for the operator to direct the radio torpedo from any height, air bubbles from the compressed air motor of the torpedo giving him a certain guide by which to steer it against a ship's hull. By use of powerful glasses it has been possible heretofore to control the torpedo from shore to a distance of nearly 10,000 yards, but the aeroplane device now will make the missile effective to the full range of its motor capacity, or even far at sea if the torpedo is launched from a swift motor boat within sight of a hostile ship.

The Hammond plans are now before the House Fortifications Committee, which is giving detailed consideration to the proposal to spend more than $80,000,000 on improving the coast defences within the next four years.

## BOWLERS IN WIRELESS TOURNAMENT

The wireless bowling tournament between Pacific Coast and Hawaiian Y. M. C. A. organizations was set in motion on January 6, at San Francisco, when the Naval Training Station "Y," from Goat Island, bowled a total of 2,609. This score was immediately wirelessed to Honolulu, Sacramento, Fort McDowell, Oakland, San Jose, Los Angeles and Vallejo, all these sections having teams in the tournament. In the first contest the high score rolled was 569.

The tournament was continued for two weeks, the scores of all games being exchanged by wireless.

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# Queries Answered

**Answers will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all letters and only one side of the paper written on; where diagrams are necessary they must be on a separate sheet and drawn with India ink. Not more than five questions of an individual can be answered. To receive attention these rules must be rigidly observed.**

## Positively no Questions Answered by Mail.

W. S. E., Wichita, Kans., inquires:

Ques.—(1) How can one best determine if the antenna is radiating properly?

Ans.—(1) Normal radiation takes place from any aerial with normal current flow. The actual effectiveness can best be determined by experiment. If there is no leakage at the aerial insulators and the aerial hot wire ammeter indicates normal current flow then the maximum degree of efficiency has been attained.

Ques.—(2) Does the hot wire ammeter indicate the degree of coupling between the open and closed oscillation circuits, or the character of the emitted wave?

Ans.—(2) Positively no. It is merely employed for indicating conditions of resonance between these circuits.

Ques.—(3) Does the hot wire ammeter indicate anything more than the fact that current is actually flowing in the antenna system

Ans.—(3) No.

Ques.—(4) Is the matter of radiation as understood in wireless telegraph work determined by the degree of coupling between the two circuits, the quality of the spark, the efficiency of the condenser or by the deflection shown on the hot wire ammeter?

Ans.—(4) The actual radiation of energy from an antenna system is denoted in the terms of an equivalent resistance. That is to say, the energy lost by radiation from a wireless telegraph aerial is expressed as the equivalent of the number of ohms of resistance required in an identical non-radiative oscillatory circuit to reduce the current value to a similar value as obtained in a radiative circuit, such as an aerial system.

For a flat top aerial of vertical height, h, the radiation resistance is computed as follows:

$$R' = 160\pi^2 \frac{h^2}{\lambda^2}$$

where R' = the radiation resistance in ohms;
h = the height of the aerial in meters;
λ = wave-length of the aerial in meters.

The power radiated from a flat top or T aerial of a given vertical height is expressed by the following formula:

$$W = 1578.2 \frac{h^2}{\lambda^2} I^2$$

where h = the height of the flat top in meters;
λ = the wave-length of the flat top in meters;
I = the current measured at the base of the antenna system by a hot wire ammeter.

For a single wire, i. e., plain aerial, this formula becomes:

$$W = 640 \frac{h^2}{\lambda^2} I^2$$

We thus see that the radiation from an aerial depends upon its height, wave-length and the current supplied to the antenna system.

The power radiated from any aerial computed in watts is as follows:

$$W = R' I^2$$

where R' = the radiation resistance only in ohms; and
I = the current measured by hot wire ammeter at the base of the antenna system.

You will readily see that if the degree of coupling between the primary and secondary circuits of an ordinary radio transmitter is reduced, the current at the base of the antenna system will decrease (as per the formula) and the energy radiated will also decrease. For effectiveness as regards radiation the transmitting aerial should possess a high radiation decrement, but if of too great value the emitted wave is not sharp. We must therefore strike a happy medium in order that the advantages of one may not offset the advantages of the other.

It is considered preferable in commercial practice to confine the energy of the emitted wave to a single frequency or as near that condition as possible. With tight coupling between the primary and seconary circuits the antenna system generally radiates at two frequencies and it is usually possible only to tune the receiving apparatus to one; therefore the energy in the other frequency or wave-length may be considered as lost.

* * *

C. F. O., Schenectady, N. Y.:

Your single wire aerial, 450 feet in length with an average height of 35 feet, has a natural period in the vicinity of 710 meters.



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There is no harm in having the two ends of the antenna at different heights nor will there be any loss of signals on this account.

A suitable primary winding for the receiving tuner (secondary winding described in the article of the series, "How to Conduct a Radio Club," published in the February, 1915, issue of THE WIRELESS AGE, can be made on a form 7 inches in diameter by 10 inches in length, wound closely with No. 24 wire. In addition, a loading coil about 10 inches in length by, say, 5 inches in diameter, wound closely with No. 20 S. S. C. wire, should be connected in series with the antenna system. Since you desire to use this coil to receive signals from Sayville we take the opportunity to say that this station operates with undamped oscillations at a wave-length of about 8,400 meters, and in consequence you will require receiving apparatus suitable for the reception of undamped oscillations in order that you may hear Sayville's signals.

We do not know whether the United States authorities will allow a special license for a wireless telephone experimental set in your vicinity. You should communicate with the Department of Commerce at Washington, D. C.

We are unable to advise you specifically concerning the operation of a polarized relay in connection with the multi-audi-fone. We do not know the principles upon which this device works, but if the signals in the telephones are as loud as you report, it would seem that sufficient energy flows to operate a sensitive polarized relay. However, you should take into consideration the fact that in order to receive the dots and dashes in the Morse code, it would be necessary for the armature of the relay to be adjusted for a sluggish movement in order that the individual sparks composing the dash might record properly.

We do not advise the use of freakish aerials as described in your fourth query. Your single wire, 450 feet in length, should be sufficient for long distance work.

* * *

H. R., Yonkers, N. Y.:

The fact that an applicant for admission to the Marconi service wears eye-glasses will not bar him from being accepted provided he possesses the necessary qualifications for admittance. We know nothing of the wireless school to which you refer.

* * *

S. O., Dallas, Texas, inquires:

Ques.—(1) What is the wave-length of a single wire aerial 600 feet in length, 85 feet in height at one end and 15 feet at the other?

Ans.—(1) The wave-length of this antenna is approximately 930 meters.

Ques.—(2) What size condenser would you advise in series with this aerial?

Ans.—(2) This aerial is by far too large for operation at a wave-length of 200 meters. The flat top portion for one of the inverted L type should not be more than 60 or 70 feet to be operated at the restricted wave-length.

P. R. C., Bradentown, Fla., inquires:

Ques.—(1) Please give data concerning NAT (New Orleans station) in regard to the power, wave-length, and whether damped or undamped oscillations are employed.

Ans.—(1) The naval station is fitted with a 30 k. w. arc set which operates at a wave-length of about 6,000 meters and can be heard at intervals throughout the day. Special apparatus is required for these signals. We have no data concerning the spark equipment used at this station.

Ques.—(2) In adjusting a transmitting set how do you determine the wave-length and the logarithmic decrement?

Ans.—(2) The wave-length is best determined by means of a wave-meter set in inductive relation to the antenna system. For measurement of the logarithmic decrement a hot wire wattmeter or hot wire milliammeter is connected in series with the wave-meter and certain determinations are made. The complete measurement is described in the book, "How to Conduct a Radio Club," published by the Marconi Publishing Corporation.

Ques.—(3) Please advise me regarding the proper dimensions of a sending condenser for a ½-inch spark coil.

Ans.—(3) A condenser is not recommended for a coil of this size. It is preferable to connect the spark gap of the coil directly in series with the antenna system. A single plate of glass, 8 by 8 inches, covered with tin-foil, 6 by 6 inches, should give sufficient capacity for the secondary potential of this coil.

* * *

A. G. F., Allentown, Pa.:

To decrease the wave-length of a receiving aerial the variable condenser should be connected in series with the earth lead of the antenna system. To increase the wave-length the condenser must be removed from this circuit and connected in shunt to the primary winding. A variable condenser is not necessary across the telephones on the average receiving set. A fixed condenser having a capacity of from .005 to .04 of a microfarad will fulfil the requirements.

The wave-length of an antenna system is not increased much by the addition of another wire. In fact, it will increase the wave-length very slightly unless there is considerable spacing.

* * *

T. O. B., Freeport, N. Y.:

Ans.—(1) We believe there has been an error. Receiving condensers having a capacity of 2 microfarads are not generally employed in wireless work. In any event, we advise purchasing a condenser of this type (having a dielectric of wax paper) rather than constructing one. We believe it will be the cheaper method. Generally these condensers consist of two very long sheets of foil, about 90 feet in length by 6 inches in width, separated by a very thin sheet of paraffine paper. The entire unit is then rolled up in circular form and sealed in a container.

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If you desire to wind single layer coils to have a certain value of inductance we refer you to the article appearing on page 843 of the August, 1915, issue of THE WIRELESS AGE. The method for this calculation is fully explained and the explanation is made in such a manner that it can be understood by the amateur.

The inductance in centimeters of a single layer coil can also be calculated from the following approximate formula:

$$L = \frac{(5 \times D \times T)^2}{M + \frac{1}{3} D}$$

Where D = the diameter of the coil in inches.
T = the total number of turns of wire.
M = the length of the coil in inches.
L = the inductance of the coil in centimeters.

To convert centimeters to microhenries, divide by 1,000.

The complete method for measuring the capacity of an antenna system is described in the book, "How to Conduct a Radio Club." The construction of the auto-transformer is also described. An auto-transformer is generally considered as one where the primary and secondary circuits make use of the same turns, or at least have turns in common.

The variometer is also described in the book, "How to Conduct a Radio Club." Full instructions are given for the construction of two variometers, one to be used in an antenna system, and the second as a variable element of a wave-meter.

* * *

F. C. M., New Orleans, La., inquires:

Ques.—(1) Please give the formula for calculating the approximate wave-length to which a coil without a condenser will respond. The coil is to be used as the secondary winding of a receiving tuner.

Ans.—(1) The natural wave-length of a single layer coil can be computed from the following formula:

$$\lambda = 18.85 \ (10^5) \ \sqrt{LC_d}$$

where $\lambda$ = the wave-length in meters;
L = the inductance of the coil in henries;
C = the distributed capacity of the coil in farads.

The value of $C_d$ can be obtained from the formula and table given on page 269 of the January, 1914, issue of THE WIRELESS AGE. The value of L is computed as per the article appearing on page 843 of the August, 1915, issue of THE WIRELESS AGE.

The foregoing values merely give the natural wave-length of the coil and do not take into consideration the effect of shunting a crystalline detector and fixed condenser about it. The actual change in wave-length due to the shunt circuit depends upon the resistance of the crystalline detector. If the resistance of the crystal is excessive it will have little effect upon the natural period of the coil.

The natural wave-length of the coil can best be obtained in the following manner:

A crystalline detector shunted by a head telephone is attached to one end of the coil. A wave-meter set into excitation by a battery and buzzer is very loosely coupled to this coil and the variable element of the wave-meter altered until a loud response is secured in the head telephone. The setting of the variable element of the wave-meter (usually the condenser) is observed, which is, of course, the natural wave-length of the coil under measurement. The more accurate method is to excite the coil by impulse excitation. A quenched spark circuit can be inductively coupled to the coil. A wave-meter shunted by a crystalline detector and head telephone is then placed in inductive relation to the coil and the position of resonance noted by the loudest sound in the head telephone.

Ques.—(2) By what formula can the natural wave-length of an aerial be calculated?

Ans.—(2) An article by Cohen, published by the Bureau of Standards, Washington, D. C, contains the correct formula for calculating the distributed capacity and the effective inductance of an aerial system. A similar article appeared in The Electrician for February, 1913. The natural wave-length of a four-wire aerial, the wires being spaced from two to three feet apart is approximately 4.8 times the linear dimensions.

Ques.—(3) In Mr. Apgar's article in the September, 1915, issue of THE WIRELESS AGE, what is the function of the loading coil in the wing circuit marked "L"

Ans.—(3) This coil is intended to place the wing circuit in resonance with the grid circuit, thereby increasing the amplifications.

Ques.—(4) In the construction of a tuner for wave-lengths up to 10,000 meters should the loading coils in the primary and secondary circuits be coupled together?

Ans.—(4) Not if there is sufficient coupling between the primary and secondary windings proper. The coupler should be constructed so that a degree of at least ten per cent. between the primary and secondary circuits can be obtained.

Ques.—(5) If the secondary winding consists of No. 32 wire and the secondary loading coil is of similar dimensions, would the resistance of the wire be detrimental to the efficiency of the tuner? The secondary winding of the tuner in question is adjustable to 5,000 meters and the loading coil is a duplicate of the secondary winding. The tuner is fitted with dead-end switches.

Ans.—(5) The arrangement as described is satisfactory for use with the vacuum valve detector. In connection with crystalline detectors it may prove more efficient if the inductance in use is slightly reduced and the necessary wave-length value obtained by a shunt condenser. Keep in mind that doubling the inductance of an oscillatory circuit only increases the wave-length by the square root of 2, ($\sqrt{2}$). In consequence this tuner is adjustable to 7,000 meters. However, the addition of a slight value of capacity in shunt to the secondary winding will allow adjustments to wave-lengths including 10,000 meters.

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R. G. P., Jamaica, N. Y., inquires:

Ques.—(1) What is the fundamental wave-length of my aerial which consists of four wires spaced 3½ feet apart, 75 feet in length by 50 feet in height at both ends?

Ans.—(1) The fundamental wave-length of this antenna is approximately 228 meters.

Ques.—(2) What is the receiving range of a Marconi type D tuner fitted with a carborundum detector and a pair of Brandes 1,000-ohm head telephones? This apparatus is to be used with the aerial referred to in my first query.

Ans.—(2) The night range of this equipment is from 600 to 1,000 miles; the daylight range is from 150 to 300 miles. Increased range from high power stations may be expected by the use of a larger aerial.

Ques.—(3) Would it be any advantage to use a variable condenser with the apparatus referred to? If so, in what part of the circuit should it be connected?

Ans.—(3) A variable condenser will be of little advantage except for the shorter wave-lengths. For the reception of amateur signals this condenser might be connected in series with the earth system, thereby reducing the fundamental wave-length of the antenna by a certain amount

* * *

B. M. B., Belfast, Me.:

The solution of the majority of your problems in connection with long distance receiving can be found in the book, "How to Conduct a Radio Club," published by the Marconi Publishing Corporation. Extremely sensitive receiving apparatus is required for taking down the signals from the Marconi station at Glace Bay, N. S. This station has strong directional tendencies, the greater part of the energy being radiated in the direction of the British Isles. The wave-length employed is 7,925 meters and the power is from 70 k.w. up. Hand transmission as well as automatic transmission is employed. The automatic transmitter operates at a speed of about fifty words a minute.

The wireless telephone tests at Arlington have been discontinued. The wave-length employed was in the neighborhood of 7,000 meters.

* * *

G. S. H., Lakewood, N. J.:

Your aerial, 100 feet in length by 50 feet in height, has a natural wave-length of approximately 252 meters. The dimensions of a receving tuner suitable for the reception of Arlington time signals are fully described on page 214 of the December, 1915, issue of THE WIRELESS AGE. Duplicate these dimensions and learn by experience how to adjust a crystalline detector to a sensitive condition. You will then have no difficulty in receiving Arlington time signals, day or night, at your station.

* * *

P. W. H., Fredericktown, Ohio:

For a 3-inch spark coil a range of twelve miles is fairly good, particularly if it is operated at the restricted wave-length of 200 meters. The only means by which the range of this station can be increased is to fit the receiving apparatus with a vacuum valve amplifier set. It may be that local conditions are not conducive to long distance transmission but even under the best operating conditions your apparatus has a good range.

* * *

L. G. B., Keene, N. H.:

With the apparatus described in your communication you should experience no difficulty in transmitting and receiving at a distance of three miles. The necessary diagram of connections is contained in the book, "How to Conduct a Radio Club," published by the Marconi Publishing Corporation. Diagrams of connections for both transmitting and receiving apparatus are published.

It is difficult to eliminate the induction from nearby power wires. The effect may be reduced by the use of a balancing out aerial, but it is a difficult problem to eliminate it entirely.

* * *

A. H., Brooklyn, N. Y.:

Any of the supply houses advertising in this magazine can furnish you with apparatus for the reception of time signals from Arlington. You require for this work a receiving tuner, adjustable to wave-lengths up to 2,800 meters, and a two or four wire aerial at least 100 feet in length. The additional apparatus required consists of a sensitive crystaline or vacuum valve detector and a pair of sensitive head telephones. The cost of this equipment is not prohibitive.

We advise the use of the type E tuner, described in the Used Apparatus Catalog issued by the Marconi Wireless Telegraph Company of America.

* * *

J. T. S., Pittsburg, Pa., inquires:

Ques.—(1) Where can I obtain a copy of all the abbreviated numerals and phrases, including the comma, period, colon, semi-colon, etc., used by the Marconi operators?

Ans.—(1) Communicate with the Department of Commerce and Labor or the radio inspector in your district and secure a copy of Forms Nos. 772 and 773.

*Readers who submit questions to this department will greatly facilitate the work of its editor by not requesting immediate answers. Many questions received do not appear in these columns because they are not of general interest. Every effort is made to give prompt service, but as we usually have on hand for each issue more than 5,000 queries, it is obvious that all cannot receive immediate attention.*

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The construction of the 1 to 1 transformer for use in connection with a vacuum valve amplifier is fully described in the book, "How to Conduct a Radio Club." It has also been fully described in the Queries Answered Department of THE WIRELESS AGE. It consists of an iron core wound with several layers of S. S. C. wire. The same turns are used for the secondary and primary windings.

* * *

E. G. R., Trenton, N. J.:

We have had no experience with the silicon antimony combination as a receiving detector and therefore cannot campare it with some of the well-known combinations in commercial use.

We have not exact information concerning the power employed during the wireless telephone tests at Arlington, but it has been said that at least 80 k.w. of energy flowed in the antenna circuit.

Your 250-foot aerial has a natural wave-length of about 430 meters. It is likely that the amateur stations which you hear on this aerial have wave-lengths in excess of 200 meters, or perhaps an excessive value of coupling is used at their transmitters and consequently one of the emitted waves is above the United States restrictions.

The Arlington station uses a wave-length of approximately 7,000 meters when working with Lake Bluff, Ill. The wave-length of the Lake Bluff station is about 6,000 meters and the power employed 30 k.w. The arc type of transmitter is used at both stations.

* * *

W. L. M., New Braunfels, Tex., inquires:

Ques.—(1) Assuming that my apparatus is to be operated at a wave-length of 425 meters and furthermore, that all other conditions are equal, which of the two forms of aerial do you consider the more efficient for sending: the inverted L type or the umbrella type? In either case the aerial is to be seventy feet in height with no obstructions in the near neighborhood, as the station is located on a hill.

Ans.—(1) For a wave-length of 425 meters, we prefer an aerial of the inverted L type by all means. If the means were available for erecting an aerial of greater height, we might consider the use of an umbrella aerial.

With the 1 k.w. apparatus described you should be able to cover from 40 to 100 miles at night, possibly more.

* * *

J. W. L., Jr., Philadelphia, Pa., inquires:

Ques.—(1) Please advise me concerning the size of a transformer necessary to transmit 100 miles at night over land with an aerial having a wave-length of 200 meters, which I understand is necessary to comply with the government law?

Ans.—(1) For the restricted wave we advise the use of a ½ k.w. transformer, having a secondary voltage of 20,000 volts. The apparatus should be fitted with a non-synchronous rotary gap for the production of semi-musical tones. To insure continuous communication the receiving station should be fitted with a vacuum valve detector or amplifier.

Ques.—(2) My station is very close to the Pennsylvania Railroad Main Line Division which has recently installed high voltage circuits and without doubt I shall experience trouble from electrostatic induction. Is there any danger that sufficient potentials will be induced in the aerial to burn out my apparatus? Would it be preferable to place my aerial at right angles to the power line, rather than parallel to it?

Ans.—(2) The aerial system must by all means be placed at right angles to the power line and, even with this precaution, you will probably be troubled in your receiving work. You need not fear that your apparatus will be burned out.

Ques.—(3) What should be the size of dimensions of an aerial to get the maximum range at the restricted wave? I am somewhat limited by local conditions as regards height and length. There is sufficient space to erect a flat top aerial about 75 feet in length by 50 feet in height.

Ans.—(3) We advise you to erect an aerial with a flat top portion, 75 feet in length, and bring the lead in from the center. The aerial will then have a fundamental wave-length of less than 200 meters, which can be brought to normal value by the insertion of the secondary winding of the oscillation transformer.

* * *

A. L., Winsted, Conn.:

Ans.—(1) Duplicate the diagram of connections (Fig. 4) shown on page 52 of the October, 1915, issue of THE WIRELESS AGE. This circuit will afford the maximum degree of efficiency with a vacuum valve detector and should clear up your problem. The secondary winding of the average amateur tuner is not properly designed for use in connection with a vacuum valve. It should be so constructed that for a given wave-length an exceedingly small condenser is used in shunt to the secondary winding. This affords a maximum value of potential which is necessary to receive loud signals. Look carefully and see that the positive plate of the high potential battery in the wing circuit is connected to the plate of the vacuum valve. Also make sure that the filament of the valve has not curled up and touched the grid.

Ans.—(2) The Sayville station is still in operation, but employs undamped oscillations at a wave-length of about 9,000 meters.

Ques.—(3) To secure employment in the Marconi Service, must the operator possess a first grade commercial operator's license and is he required to take a course in the Marconi School of Instruction?

Ans.—(3) Those in the Marconi Service must possess first grade license certificates. All applicants for admission to the service are required to attend the Marconi School for a short period, in order to familiarize themselves with the latest type of commercial apparatus.

Ques.—(4) How long, approximately, is it necessary for a student to attend the Marconi School of Instruction?

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Ans.—(4) The actual length of time depends upon the previous training of the student. A student is qualified for the commercial service when he is able to make a clean, legible copy of a radio message in the Continental Code, at the rate of twenty-five words a minute. He must also be familiar with the International, United States and United States Naval regulations pertaining to wireless telegraphy. He must be able to make proper abstracts of commercial radio traffic and have knowledge of the Marconi method of accounting. He is also required to possess a detailed knowledge of commercial radio sets, in order that he may make repairs in case of emergency.

* * *

W. C. K., Melrose Highlands, Mass., inquires:

Ques.—(1) Please give a list of the additional stations (other than Arlington) on the Atlantic coast that employ wave-lengths of 1,500 meters or over and also make use of damped oscillations.

Ans.—(1) The Marconi station at Cape Cod, Mass., operates at a wave-length of 2,160 meters. The call letters are WCC. The Marconi station at Philadelphia (call letters WHE) operates at a wave-length of 1,650 meters. The Marconi station at Wanamaker's, in New York City (call letters WHI) operates daily on a wave-length of 1,850 meters.

Ques.—(2) What is the wave-length of my indoor aerial, 50 feet in height and 50 feet in length, consisting of four wires spaced 2 feet apart? The lead-in is about 25 feet in length.

Ans.—(2) The natural wave-length of this aerial is approximately 177 meters.

Ques.—(3) With this aerial, using an inductively-coupled receiving tuner, loading coil, galena detector, fixed condenser and a 1,000-ohm receiver, I am able to receive signals from Arlington. By also using a variable condenser, would it be possible to receive signals from Key West?

Ans.—(3) The spark station at Key West, Fla., operates on a wave-length of 1,600 meters. A variable condenser would be of no value for the amplification of signals. The Key West station also operates with an undamped oscillation set at certain hours of the day at increased wave-lengths.

Ques.—(4) In what part of the apparatus would you suggest that a variable condenser be connected?

Ans.—(4) If the secondary winding of the receiving tuner is already fitted with a variable condenser we see no use for another. It might be employed advantageously in the reception of the shorter wave-lengths, but for wave-lengths in excess of 600 meters it is unnecessary.

* * *

J. E., Philadelphia, Pa., inquires:

Ques.—(1) What size wire is proper for an earth connection when using a 1-inch spark coil as a transmitter? Is it desirable that this wire be well insulated? My present earth connection seems to allow the spark to jump into the side of the house.

Ans.—(1) The earth connection should be of, say, No. 4 solid or stranded copper wire. The sparking taking place in your present earth wire indicates that you have a poor earth connection and consequently a difference of potential is set up between it and the building.

Ques.—(2) How often should the high potential batteries in my vacuum valve detector be renewed?

Ans.—(2) This query cannot be answered definitely, for the actual life of these batteries depends, to some extent, upon the length and conditions of service. Ordinarily speaking, they will last from eight months to one year.

Ques.—(3) Do you know of any method for fastening the guy wires of a mast to a tin roof without doing damage?

Ans.—(3) Not knowing the construction of the building, it is difficult to give advice. We cannot see how this can possibly be done without putting eye bolts in the roof. This work, if placed in the hands of a good tinsmith, should do no particular damage.

* * *

F. V. E., Portsmouth, Va., asks:

Ques.—(1) Where can the following be purchased: Tellurium, galena, cerusite, arsenic and pyron?

Ans.—(1) Messrs. Eimer & Amend, 205 Third Ave., New York City.

Ques.—(2) Which are the best for general purposes, the 3,000 ohm or the 2,000 ohm telephones? I have heard that on account of their higher resistance, the 3,000 ohm telephones will not respond to weak signals.

Ans.—(2) The actual value of resistance is not so important as the construction of the telephone itself. Generally speaking, telephones of high resistance if properly constructed, give better signals with the crystal detectors than those of a lower value, although we have experimented with telephones of low as 1,000 ohms resistance which gave better signals than very high-priced telephones having 5,000 ohms resistance. It is not the actual resistance which determines the sensitiveness, but the magnetic effect produced on the diaphragm with a given amount of current which counts.

Ques.—(3) What should be the distance between the secondary and primary windings of the receiving transformer? I have one in which the secondary is 3½ inches in diameter and the primary 5½ inches in diameter. Would I secure better results if the coils were nearer the same size?

Ans.—(3) This is entirely a matter of coupling and if you desire a very tight coupling it would be better to have the coils of like proportions, so that one just slides into the other. If, however, you desire in the majority of cases to work with a small value of coupling, you may allow the measurements to remain as they are.

Ques.—(4) In the article, "How to Conduct a Radio Club," in the January issue, the secondary of the receiving transformer is larger than the primary. Is the primary meant to go inside of the secondary?

Ans.—(4) Yes.

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# SPECIAL EXTENSION NOTICE

## Announcement and Application Blank

# National Amateur Wireless Association

PRESIDENT, Guglielmo Marconi.

NATIONAL ADVISORY BOARD OF VICE PRESIDENTS

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ADMINISTRATIVE OFFICERS:

ACTING PRESIDENT,
J. Andrew White,
Editor, THE WIRELESS AGE.

MANAGING SECRETARY,
Clayton E. Clayton,
450 4th Avenue, New York.

A national organization of wireless amateurs was announced in the October, 1915, number of THE WIRELESS AGE. Further details of the organization are given in an address made by J. Andrew White, which was published in the November WIRELESS AGE. Reprint copies sent upon request.

### ENROLLMENT OF CHARTER MEMBERS.

Charter members of the National Amateur Wireless Association will be enrolled on special arrangement. Charter members will receive the following:

### CHARTER MEMBERS' EQUIPMENT.

1st. **CERTIFICATE OF MEMBERSHIP.**

The handsomely steel-engraved Certificate, with shadow background half-tone, is sealed and signed by Officers, with the endorsement of Senatore Marconi, as President. Every member will want to frame and place it alongside of his Government License certificate, two documents establishing status as wireless amateurs.

2nd. **AERIAL PENNANT.**

The 36 inch aerial pennant, painted in four colors on scarlet felt, will stand long service at your aerial mast head. Every member will be proud of the National Insignia flying from his aerial.

3rd. **MEMBERSHIP PIN.**

The National Amateur Wireless Association Pin in gold and enamel is the National emblem of the Association. The design shown on this page can but faintly describe its handsome appearance in three colors and gold. The pin has a special patented hub and shank which permits it being securely fastened on the coat lapel or on the vest without turning upside down.

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**4th. HOW TO CONDUCT A RADIO CLUB.**

This splendid book, which has been months in preparation and incorporates portions of articles running under the same title in THE WIRELESS AGE, is re-written to cover every new development, and with a large proportion of new matter. It is the foundation stone of the National Amateur Wireless Association activities. Price of this book 50c.

**5th. LIST OF RADIO STATIONS OF THE WORLD.**

Revised Edition just published. See advertisement. Regular 50c edition.

**6th. HOW TO PASS U. S. GOVERNMENT WIRELESS LICENSE EXAMINATIONS.**

Regular 50c edition of this popular book. Members who already have a copy, see concessions below.

**7th. MONTHLY BULLETIN SERVICE.**

It is intended to make the monthly bulletin service for members of the National Amateur Wireless Association one of the most important features of the Association. This bulletin is to be used in connection with "List of Radio Stations of the World" described above. It will carry all additions (both amateur and commercial) to "List of Radio Stations of the U. S.", issued by the Bureau of Navigation, U. S. Department of Commerce, and secured for members at 15c a copy. It is issued only once a year. The Association Bulletin will keep both lists up to date for you month by month, and in addition, will carry other special and invaluable Association features not obtainable elsewhere.

**8th. ONE YEAR'S SUBSCRIPTION TO THE WIRELESS AGE.**

THE WIRELESS AGE becomes the Official Organ of the National Amateur Wireless Association and will contain full reports of wireless amateur activities, both national and local. It is planned to give published recognition to individual amateur achievement.

## CONCESSIONS:

Those who, *during the past six months,* have become subscribers to THE WIRELESS AGE, or have renewed their subscription, or have purchased any portion of the Charter Membership Equipment, may consider such payment as partial payment of Charter Membership Application as given below. If you have paid for a subscription to THE WIRELESS AGE which includes books which are not a part of the Membership Equipment, then you may credit $1.25 of the remittance as partial payment on the Charter Membership. For example, you may have remitted $2.25 for the combination offer of the 1915 Year Book with one year's subscription to THE WIRELESS AGE. In this combination, the price of both the book and the subscription was reduced, to make the special offer; therefore, you may be credited only with that part of the payment which went to the magazine—that is, $1.25. Coupon subscribers receive no credit for trial orders. Subscribers to THE WIRELESS AGE who *began or renewed more than six months ago,* will secure through full Charter Membership fee a renewal for another year; and their subscriptions will be extended for one year from the time the present subscription expires.

## ANNUAL DUES FOLLOWING FIRST YEAR.

The annual dues are to be not more than $2.00, after the first year. For this, all members are to receive:

1st. The Monthly Bulletin Service.

2nd. THE WIRELESS AGE for one year.

3rd. Special 50c. Instruction Books at 30% off list price.

4th. 10% discount on any book on wireless published, and other features to be announced later.

## CHARTER MEMBERS ACCEPTED TO MAY 1, 1916.

So that clubs may have time to complete organization work now under way, and also to give ample opportunity to all who wish to become Charter Members, an extension has been allowed by the Officers and applications will be received up to May 1, 1916. After this date the Initiation Fee of $1.00 will be required from all new members.

(*Application blank on next page*)

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**SPECIAL NOTICE REGARDING CORRESPONDENCE.**

As the National Amateur Wireless Association is in no sense a money making enterprise, and as the nominal dues will cover a very small amount of handling expense, it is desired that the correspondence be limited to only the most essential necessities. Read this announcement over again before asking questions. See if the answer is not already given.

Many general questions will be answered in the Service Bulletins; special matters pertaining to local questions should be handled through the Corresponding Secretary of Local Clubs and Associations. A cordial invitation is extended to all club officials to write on matters pertaining to organization. This invitation also includes those who are interested in starting new clubs.

**Clayton E. Clayton, Managing Secretary,**
**450 4th Ave., New York.**

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Checks and money orders should be made payable to: Natl. Amateur Wireless Assn.

**APPLICATION FOR MEMBERSHIP.**

CLAYTON E. CLAYTON, Managing Secretary,

NATIONAL AMATEUR WIRELESS ASSOCIATION, Date.....

450 4th Avenue, New York City.

As I desire to receive full recognition as an amateur wireless worker of the United States, I ask the privilege of enrollment as a Charter Member in the National Amateur Wireless Association and request that you send me the Charter Members' Equipment for which I enclose herewith remittance of $2.50.* (Option.)

I trust that you will act upon my application promptly and forward the equipment to me at the earliest possible date.

My qualifications for membership are given in blank spaces below.

Signature ..... .....Age.....

Street Address .....

Town and State.....

Please credit me with $..... paid for.....

* Option.

In the event that an applicant is unable to send the entire amount of the membership dues with this application, the figure $2.50 may be crossed out and $1.00 written in its place. This will be considered an agreement on the part of the applicant accepted for Membership that the balance of dues ($1.50) will be paid at the rate of 50c per month for the next three months, at which time pin, pennant and Certificate of Membership will be issued. The other equipment will be sent at once.

**FILL IN ANSWERS TO THESE QUESTIONS.**

1—Have you a Government License (give number.....) or do you purpose applying for one?.....

2—If you are under 21 years of age, give names of two adults for references as to character.

Reference.....

Reference.....

3—If you are a member of any Local, State or Interstate wireless club or association, give its name, and name of Secretary with address.

.....

4—Are you now a subscriber to THE WIRELESS AGE?.....

5—If you already have any books included in the equipment, state which ones.....

.....

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# National Amateur Wireless Association

A DIRECTING ORGANIZATION DEDICATED TO THE PROMOTION OF RADIO COMMUNICATION

CALL LETTERS 9PY
S. W. PIERSON
CARROLLTON, ILLINOIS

GUGLIELMO MARCONI, PRESIDENT

Reduced fac-simile of letter head.

## For Clubs and Members of National Amateur Wireless Association

The following list of items of optional equipment is listed at cost price in order to give members and clubs of the Association every material advantage in the way of a complete equipment that may be desired. Prices include transportation charges.

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100 National Association Letter heads with imprint of member at left hand side, as illustrated above **75c**
Without member's imprint..... **35c**
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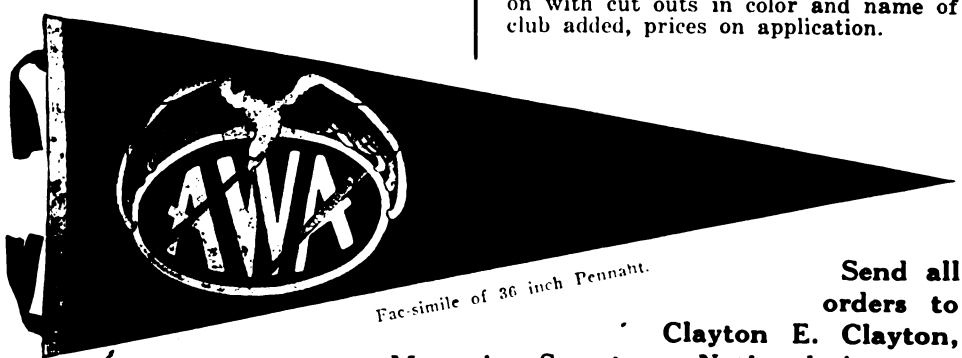


Fac-simile of 36 inch Pennant.

**Send all orders to Clayton E. Clayton, Managing Secretary, National Amateur Wireless Association, 450 Fourth Ave., N. Y. City.**


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# THE WIRELESS AGE

Owing to the fact that certain statements and expressions of opinion from correspondents and others appearing in these columns from time to time may be found to be the subject of controversy in scientific circles and in the courts, either now or in the future, and to sometimes involve questions of priority of invention and the comparative merits of apparatus employed in wireless signaling, the owners and publishers of this magazine positively and emphatically disclaim any privity or responsibility for any statements of opinion or partisan expressions if such should at any time appear herein.

MARCH, 1916

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# Wireless Transmission Problems

## An Address Delivered by Dr. Michael I. Pupin in Which Vexed Questions in Radio Telephony were Discussed

Dr. Michael I. Pupin spoke on "Wireless Transmission Problems" at a meeting of the New York Electrical Society held at the Engineering Societies Building on January 27.

In the address not only were the various problems involved in the recent developments in long distance talk transmission analyzed and solved with simplicity and clarity, but Dr. Pupin declared that the discovery and conquest of that menace and bugbear of all time—the static—was about to be given to the world. He said that this discovery, which had cost him seven years of experimentation, not to mention the work of others, will make possible the transmission of messages by wireless telephone to every part of the world.

Dr. Pupin took up in their historical order the various problems of wireless transmission A broad description of the constructive elements of the wireless transmission system was given, to show that, as far as these constructive elements are concerned, there is no essential difference between the wireless transmission system and the ordinary electrical transmission system; but the difference, slight as it is, in the constructive elements, necessitates the introduction in the wireless system of a radically different mode of operation, namely, the employment of electrical forces of very high frequency.

The earliest method of producing these high frequency electrical forces was briefly described and Dr. Pupin expressed it as his personal opinion that Joseph Henry in 1842 first discovered electrical oscillations which Marconi first employed in wireless transmission. After Prof. William Thompson formulated, in 1855, the law of motion of electricity along conductors, the time was ripe for the invention of wireless telegraphy. However, it was not invented until 1895, when Marconi, stimulated by the beauty of the Hertzian experiments, and while repeating them in Righi's laboratory in Bologna, discovered that an oscillator connected to the ground and a resonator connected to the ground gave electrical transmission by electrical waves of high frequency enormously increased range. A distinct period in wireless telegraphy was inaugurated when Marconi discovered the new art. The problems which were solved during this inventive period were few, but every one of them was epoch-making. The first problem was the substitution of the high frequency generator for the oscillator, with its noisy and unreliable spark gaps. This was accomplished by the patient and persistent work of E. F. W. Alexanderson and others.

The second great step was the introduction of amplifiers into wireless work. Dr. Pupin referred to his first announcement of the electric amplifier in 1911, made before the National Academy of Science. It was an induction generator of special construction. Since that time the vacuum tube amplifier has been developed. He said that in this connection the work of Fleming and De Forest formed the starting point. He pointed out that much had been accomplished in perfecting the vacuum tube with a hot cathode, and amplifiers that work with reliability and are capable of amplifying feeble electrical impulses even hundreds of thousands of times have been brought into use.

"But they not only amplify," he said, "they actually reproduce very feeble electrical impulses with an accuracy which defies the finest microscope ever constructed."

Dr. Pupin called attention to the fact that articulate speech transmitted from Arlington to Honolulu (4,900 miles) was reproduced at Honolulu by a vacuum tube amplifier with such accuracy that the listener at Honolulu recognized


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the speaker at Arlington, although the energy of the feeble electrical waves conveying this speech was probably amplified 100,000 times at Honolulu.

"The third great problem solved lately by the inventive genius of man," he continued, "is that of regulating the power output of the generator at the transmitting station. To illustrate: the generator at Arlington which supplied the electric energy for the transmission of speech to Honolulu, delivered something like 100 horsepower, yet its output was regulated by the human voice. It looks as if we were on the threshold of regulating the electrical output of our high-frequency generators by what may be called mere will power. In considering all these things it would seem that there is nothing to prevent us from transmitting telegraphic and telephonic signals from any point of the earth to any other point.

"And yet there is a most serious obstacle indeed. I refer to the well-known interfering action of the static. What is the static? It is the everlasting presence of electrical waves in the terrestrial atmosphere due to electrical discharges in it. The electrical charges in the atmosphere are produced by the action of sunlight and other causes. The electrical waves produced by the electrical discharges in the atmosphere are so much more powerful than the waves coming from the distant wireless transmitting station that they drown out the messages. When means have been found to protect the receiving station effectively from the disturbing influence of the static, there will be no obstacle in the way of employing wireless telegraphy and wireless telephony as the simplest means of universal communication."

In conclusion Dr. Pupin said:

"This problem is the greatest problem today in wireless transmission. It has occupied my attention for a number of years, and I know that the solution is within our reach. But I have come here to extol the splendid work of those kings of wireless who have brought us to where we are today, and not to enter into any discussion of the special problems on which I am now closely engaged."

The following were elected life members of the society: Bion J. Arnold, Putnam A. Bates, P. G. Gossler, H. G. Scott, John Bottomley and Dr. Francis B. Crocker.

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## NEW ORDER REGARDING COAL VESSELS

Dudley Field Malone, collector of the port of New York, has been notified that it is unnecessary to dismantle the wireless apparatus of bunker coal steamers of belligerent countries when they remain in port for so short a time that it is not necessary for them to "enter" and "clear."

In such cases, however, the collector is instructed to deliver to the master of the vessel a copy of the printed instructions issued by the Navy Department. The collector is also instructed to inform the master of the vessel that the ship has not "entered" and "cleared" he will not be required to seal his radio apparatus nor lower his antenna, but that the apparatus must not be used in any way, either for transmitting or receiving, until after the vessel has cleared the limits of the port.

## S O S SAVES POLLENTIA'S CREW

The British freighter Pollentia in mid-Atlantic, was leaking dangerously and in need of aid on January 19, when her operator flashed the S O S. The appeal was picked up by the Italian liner America, the captain of which instructed the Marconi operator to send out the S O S to all craft within range.

After a search which lasted until the night of January 22, the Narragansett and the Giuseppe Verdi found the distressed vessel. The sea was so rough, however, that no attempt was made to launch lifeboats and the rescue vessels stood by until daylight. On January 23 the Narragansett poured oil on the water and the Giuseppe Verdi sent lifeboats which took the crew of thirty-five from the Pollentia as she was settling in the water.

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# The Romantic Cruise of a Phantom German Raider

**How Wireless Aided a Naval Auxiliary in the Capture of the African Liner Appam and Seven Other British Prizes**

FROM the decks of the British steamship Appam, some eight miles off Madeira, was sighted on the afternoon of January 15, a vessel which seemed to be in distress. She would go forward for a short distance, turn to one side, come to a stop and then repeat her erratic performance. It looked like a case of steering or engine trouble, and the Appam's people characterized her as "just an ordinary tramp" in need of aid.

*Robert Jones, operator on the Appam*

They could not know, as reports of her exploits afterwards purported, that she had stolen silently away from Kiel a short time before and, with darkened port holes and wireless operators "listening in" to warn the German commander of the positions of enemy craft, had made her way through the cordon of British warships in the North Sea; they could not know that the so-called tramp was accompanied by a scout ship which had successfully scoured the waters in search of other entente craft and informed the raider by wireless of the prospective prizes, even as the sea rover had been told of the Appam and where to find her.

And so those on the Appam, still unsuspecting, looked on with amused interest as the strange vessel came nearer. It was not until the latter was within easy range of the British ship that she disclosed her real character. Then a lightning-like transformation in the nondescript appearing craft was effected. Just as the scenes are shifted in a play, plates were lifted, revealing a formidable array of guns; armed men, too, were shown tramping the decks. A peremptory command to heave to at once was sent by signal. This was followed by the order: "Stop wireless immediately, or we will sink you." Came two shots to emphasize the command.

Thus was the Appam included in the list of eight prizes which the German raider, described as the Moewe, or the Ponga, captured.

Quite properly has the Moewe been called the phantom ship of the seas, for her movements are for the most part shrouded in mystery. However, it is known that her men spent Christmas in Kiel, and it is believed that she began her depredations soon afterward. It is not difficult to bring to mind the swift run of the vessel through the British blockade. Doubtless her success in eluding the ships of her enemy was due in a measure to the reliance which her commander placed in wireless and wireless men, for on the rover were six radio operators who maintained six continuous watches. And it is likely also, declare those who have followed the history of the cruiser, that she used a direction finder in order to determine the positions of the British craft. Her wireless men, of course, preserved absolute silence, employing their time in "listening in."



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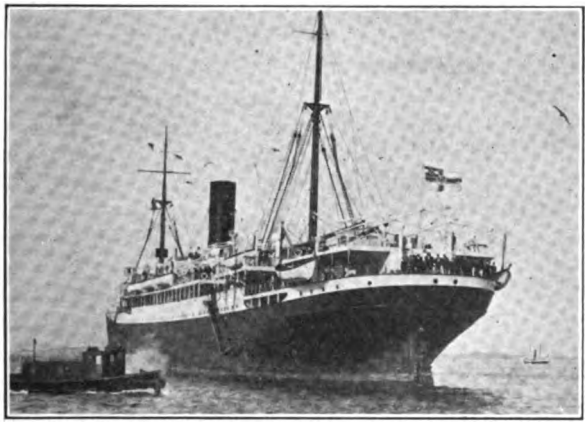
Some time after the cruiser had run the gauntlet of British war craft, so the story of her exploits goes, she met the scout ship. The latter vessel is described as a smaller craft than the Moewe and capable of making better speed. It was her duty to comb the ocean for merchant vessels flying the flags of the entente and report her finds by wireless to the cruiser. How successfully wireless was employed in this undertaking is shown by the record of the raider's cruise.

First to fall a victim to the sea rover was the Corbridge which was taken on January 10. Her cargo of coal was seized and she was sunk. The Farringford was sunk on the same day and three days later the Dromonby, Author and Trader were sent to the bottom. On January 15 the Ariadne was sunk, the next day the Appam was captured and on January 17 the Clan McTavish was sunk. All of these vessels flew the British flag and six of them were captured in the open Atlantic.



*The British liner Appam steamed into Hampton Roads, flying the German naval ensign. She was manned by a prize crew from the mysterious German commerce raider*

As to the Appam, she was voyaging from Dakar, French West Africa, to Liverpool, in her wireless cabin being Marconi Operator Robert Jones.

"We sighted a tramp steamship proceeding in the same direction as ourselves," he said, in telling of the capture of the vessel and the events which followed. "Little notice was taken of her, as it is not unusual to see ships of her type in the waters where we were. She was quite close to us at half past two o'clock in the afternoon and the officer on the bridge remarked, 'Look at that old tramp.' The next thing we knew she was flying signals to 'stop instantly.' There was no flag to denote her nationality, however. We thought she was in distress, but I was on duty all this time and had heard nothing from her.

"She flew more signals, giving orders not to operate the wireless or she would sink us, and then unfurled the German ensign to the breeze. Then she fired two shots. From the Appam's bridge came to me: 'Don't touch those keys, or she will sink us.'

"A naval lieutenant on the Appam rushed aft, where we had a gun, with the intention of throwing the breach overboard and rendering the gun useless. The cruiser's men observed him and started sniping at the gunners, one of whom had his cap shot off his head.

"By this time the Germans had boarded us and three German wireless operators with loaded revolvers and a kit of tools entered my cabin. They demanded my inventory. This demand I refused to comply with and started to leave the cabin. They stopped me, however, and opened every drawer in my cabin in an effort to find the object of their search. Then they began to dismantle the set, using for this purpose a hammer and chisel. I learned afterwards that they believed that the Appam was to be sunk and intended to convey the apparatus to the German cruiser.

"This was a wrong impression, for after a while, when orders came for the Appam's officers and sailors to be transhipped to the cruiser I was told to remain on board. The reason for this order developed later when a command was issued to replace the wireless apparatus. It seems that I was wanted to aid in the work."

Jones said that one of the German operators with whom he talked commented on the excellence of the Marconi magnetic detector on the Appam. Crys-

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tals were used on the Moewe and, in the words of the cruiser's wireless man, "Every time the ship fired her guns, the crystals were placed out of adjustment and for a few minutes it was impossible to receive."

"A German officer sent for me the next morning (January 17)," continued the Marconi operator, "and commanded me to put the wireless set in order again. I refused flatly to comply with the order and at half past five o'clock in the afternoon I learned that I was to be taken to the German cruiser as a prisoner. I was on deck with my luggage, waiting to go to the raider, when smoke was sighted on the horizon. This came, as we afterward learned, from the funnels of the Clan McTavish. The men on the cruiser had no sooner sighted the smoke than she steamed away at top speed toward it, accompanied by the Appam.

"The raider and the McTavish a short time afterwards began to exchange signals by Morse lamp. The German asked the McTavish regarding her identity and the British ship replied with a similar question. The Moewe answered that she was a German cruiser, but those on the Clan McTavish showed by their answer that they were skeptical regarding the statement, or defiant. The result was an exchange of shots. The cruiser fired seven shots from her big guns and also launched a torpedo. The McTavish returned the fire with several shots from her six-pounders. In view of the odds against which she was contending, she fought well, but after she had lost half of her Lascar crew and sustained damage to her engines, she surrendered, being in a sinking condition.

"The Germans boarded her, ordered her crew to leave and placed on board two large bombs with fuses attached. We were a considerable distance away, but we could hear the explosions distinctly and saw the ship gradually settle into the water. The wireless operator on the McTavish in describing the capture of the vessel, said that he flashed the distress call, but the 'jamming' of the operators on the cruiser prevented it from reaching vessels of the Allies.

"The taking of the McTavish prevented me from going aboard the Moewe that night, but toward the close of the next day I was taken to the cruiser and placed below under guard. From what I overheard I inferred that my captors believed, on account of the Marconi uniform which I wore that I was a British naval officer. Then I asked to see the commander of the Moewe and, after consulting with other officers, he gave me permission to return to the Appam. When I jumped into the small boat waiting to convey me to the British vessel my box containing my clothes and money was thrown after me. It missed the boat, however, and, falling into the water, disappeared. So I clambered over the side of the Appam without any clothes but those which I wore. For all that I was thankful to be once more on the vessel."

But the adventures of the Appam did not end at this point, for with 452 persons aboard, a large number of whom had been taken from the captured vessels, and a German prize crew in charge, she steamed for Newport News. Sometimes scudding along so rapidly that the throb of her engines shook her from stem to stern; at others limping and halting, with her wireless almost constantly in use, she jockeyed through the ocean lanes and past the enemy warships. From time to time her operators picked up signals which by determining their strength enabled the German commander to guess shrewdly concerning the proximity of craft suspected of being hostile. During the early part of the cruise the German operators transmitted considerably and it was the belief of those from the prize vessels that they were communicating with the Moewe. As the Appam neared the Atlantic coast, however, there was little use of the transmitting set; "listening in" was the order of the day.

In this manner did the Appam steam into Hampton Roads early on the morning of February 1 and drop anchor. It was not until then that the wireless operators doffed their head phones and relaxed their vigilance. And with the arrival of the steamship in port came the dismantling of her radio set, thus ending the wireless history of the Appam as far as her capture by the Moewe is concerned—at least for the time being.

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# Under Fire on the Hesperian

**By Robert Jones**

**The author of this article was wireless operator on the Appam when she was captured by the German raider Moewe. In the following narrative he describes the attack on the British hospital ship Hesperian on which he also was detailed as wireless man. In recognition of his services on the hospital ship he received a presentation from the Liverpool and London War Risks.**

WHEN the Hesperian left Liverpool late in the afternoon of September 3 last, bound for Montreal with 300 passengers and 250 wounded soldiers, there was little thought among those on board that she was destined to meet the fate of the Lusitania. There was so much suffering, so much of the horror of war represented on the vessel by the wounded, many of whom were blind or crippled for life, that most of us forgot present danger.

*Piece of the torpedo that struck the British hospital ship Hesperian, on her fatal trip to Montreal*

The ship had made her way well down the Irish Channel and was on the outskirts of the danger zone at about half past eight o'clock in the evening of the next day. Darkness was just falling when the attack was made. I was in the wireless cabin at the time. There was no warning, no forerunner of what was about to occur—only a quivering of the ship, cries of alarm and the muffled roar of the engine of death. For a minute I was dazed. The next instant a telephonic order came from the bridge to send the S O S and I learned that we had been torpedoed.

My flash was instantly answered by British destroyers and patrol boats. One vessel wirelessed that she was "coming at thirty-seven knots an hour." From various craft messages were sent, a destroyer asking us to "fire rockets so we can get your bearings."

Meanwhile, the situation on the Hesperian was becoming more and more perilous. The torpedo struck the vessel between two of the cargo holds forward of the bridge and lodged in one of the compartments. A period of perhaps thirty seconds elapsed before the explo-



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sion occurred. The top of a hatch was blown into the air and many persons seated on it were killed. The Hesperian listed considerably to port, but straightened herself to a certain extent.

Rockets were set off to aid the rescue ships in their search and the Hesperian's boats were lowered, the wounded and the passengers being placed in them. Fifty minutes after the ship had been struck only thirteen men remained aboard the vessel. These included the captain and some of his officers, H. Jones, second Marconi operator, and myself. All of us were relieved when a wireless came from a destroyer saying "Picked up three of your lifeboats." Thirty minutes afterward I received a message reading "All hands picked up."

The Hesperian was still afloat, but that was about all that could be said of her; the nearest port was 150 miles away. To navigate the partly-wrecked vessel to land seemed no little task for thirteen men, but they set about trying to accomplish it. For thirty-six hours we remained on the vessel. At the end of that time she was settling in the water so rapidly that I sent a message asking for aid. The waters had placed the dynamo out of commission, but I was able to use the emergency set and after a time the British destroyer Veronica, heaved to within sight of us. I was among the last to leave the ship, being compelled to jump over the side. We were all rescued, however. Seven minutes afterward I saw the Hesperian disappear beneath the waves.

My experience was simply one of the fortunes of war but I am not anxious to repeat it; for in addition to the nervous strain and excitement resulting from the torpedo attack, we who remained on the Hesperian till the last, were compelled to go without food and water during the thirty-six hours' struggle to bring the vessel to port.

## THE SAYVILLE CENSORSHIP MODIFICATION

To avoid any complications in the proposed modification of the censorship on wireless messages at Sayville, Secretary Daniels, on February 17, appointed a board of naval officers, headed by Captain W. H. G. Bullard, superintendent of the Radio Service, to consider whether the revision should permit the passage into the United States of radio messages referring to naval vessels of the countries at war.

Under the present censorship at Sayville such messages are suppressed, a notable instance being that portion of a recent German official statement which announced the sinking of the British cruiser Arabic in the North Sea.

Suppression of the announcement caused Count von Bernstorff, the German Ambassador, to ask the State Department for an explanation. Mr. Daniels explained that the censors had acted under the existing regulations, drafted by a board of naval officers after an exhaustive study of the question of radio censorship and prohibiting the transmission into this country of any message referring to "movements or location of war or other vessels of belligerents." The object of the regulation, he said, was to prevent violations of neutrality by the admission of dispatches containing information of a military value which might be used by agents of a belligerent nation in this country. In cases of the information coming officially from a foreign government and also printed in the territory of an enemy country the secretary said he believed the prohibition could be removed.

## GERMAN RAIDER CHASES LINER

The captain of the French liner Chicago, on the night of February 17th, according to a newspaper report, received two wireless messages when his vessel was nearing the Bay of Biscay, warning him of the presence of "enemy corsairs." A vessel suddenly appeared on the Chicago's starboard bow, and ordered her to heave to. The captain promptly ordered full steam ahead and the stranger gave chase for a quarter of an hour, but the Chicago was making seventeen knots and quickly outdistanced her.

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# National Association Holds Signal Corps Organization Meeting

## One Hundred New York Members Hear Military Experts on Work of Signaling Corps and Generous Response is Made to Acting President's Request for Enrollment in First Battalion

MEMBERS of the National Amateur Wireless Association residing in New York City met in Fayerweather Hall, Columbia University, on February 7 to organize a signal corps battalion of the Junior American Guard. More than one hundred radio enthusiasts learned of the progress of the local military units and were told many interesting details in connection with the use of wireless in modern warfare. The speakers were: Major William H. Elliott, vice-president of the Association; Lieutenant Robert W. Maloney, of the First Signal Corps of New York; Elmer E. Bucher, instructing engineer, and J. Andrew White, acting president.

Lieutenant Maloney, the first to address the assemblage, covered very thoroughly the work of signal corps troops in the army, both in time of peace and when engaged in war. He endorsed the principles of the Association's preparedness movement and said military men recognized the importance of being able to lay their hands on skilled men in event of emergency, noting that in his experience he had found that it required six years training to make a signal corps private a sergeant, thirteen years to make a lieutenant. It was the belief of his fellow officers, he said, that the military training purposed would establish a reserve of incalculable value should a call come to enlist under the flag. He described the field operation of cart and pack sets and illustrated with lessons learned in the present war how the fate of thirty thousand men had rested on the thin communication line set up between the artillery bases and the trench fighters. His address closed with an offer to acquaint his commanding officer with the high aspirations of the New York amateurs and to urge that permission be given to use the apparatus of the First Signal Corps Battalion of the National Guard.

Mr. Bucher followed with a talk on portable sets used in the army, illustrating his remarks with lantern slides and a complete portable equipment loaned for the occasion by the Marconi Wireless Telegraph Company.

Major Elliott confined his remarks to the objects of the military reserve and urged the members to look upon their duty to the country in a serious way. He outlined the work which would be covered in the summer camps and expressed the wish that the two companies of the signal corps battalion be builded up to full complement so the winter drilling in local armories would be effective in preparing the members for extended manœuvering in the field. He added that he was endeavoring to secure the consent of the acting president of the Association to take command of the local unit, recognizing that his military training in the early nineties and his later experience with actual warfare would be of material benefit to the corps.

Mr. White then rose to address the assemblage, saying that Major Elliott's remark had come as a surprise. The matter had been discussed, he admitted, but thus far he had been unable to decide whether his obligations as a national officer of the Association would permit specialized service to the local organization.

His formal address began with the statement that he was not lukewarm on the subject of preparedness; he consid-



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ered adequate protection for the country a great national issue and one which concerned every member of the Association, whether he lived North, East, West or South. Introducing the question of creating signal corps throughout the country, he said:

"If we are to enter into the work of preparing ourselves as efficient military units we must know just what we are to do—what we expect to accomplish, and how the result will be achieved. I might say a great deal along this line without getting anywhere; I might take you through a lengthy dissertation on your duty to your country; I might explain in detail what is expected of the signal corps in time of war, and how we can equip ourselves with military and technical knowledge to meet the demands which may be made upon us. But these things would not accomplish the purpose of our meeting tonight. Skill in radio operation and efficiency in field manœuvering will come with the training generously offered by the competent instructors who have volunteered their services without thought of compensation. So all that is in the future. Let us confine ourselves now to consideration of the practicability of this training we are to receive; let us consider, in a serious way, the value of our efforts—not the physical welfare we secure by systematic training in the open, for that is at once obvious, and attractive—but how we can accomplish a great benefit to others as well as ourselves."

The administrative head of the Association then endorsed President Wilson's appeal to the nation, saying of the Chief Executive, "Following the counsel of every true American since the nation was born, he has come out strongly in favor of a reasonably proportioned army of regulars, backed up by a huge body of men who will continue to follow the commercial pursuits of peace, but will be ready—prepared—when the time comes to take the field."

Attention was called to the remark heard daily on every side: "What we need is a good army, not a large one," which, Mr. White said, were the identical words used by Washington shortly after the disastrous battle of Camden.

Quotations were made from a letter written by Washington to the President of Congress on the inadequacy of the Continental troops. In this communication Washington noted that had we formed a permanent army in the beginning, capable of discipline, we should never have had to retreat with a handful of men across the Delaware in 1776, trembling for the fate of America; that it would not have been necessary to fight Brandywine with an unequal number of raw troops, and later see Philadelphia fall into the hands of a victorious army. According to America's first leader, too, the destitution at Valley Forge was all due to lack of trained men; in fact, quoting Washington, "We should not have found ourselves so weak as to be insulted by 5,000 men, unable to protect our baggage and magazines, their security depending on a good countenance and a want of enterprise in the enemy; we should not have been the greatest part of the war inferior to the enemy, indebted for our safety to their inactivity, enduring frequently the mortification of seeing inviting opportunities to ruin them pass unimproved for want of a force which the country was completely able to afford, and of seeing the country ravaged, our towns burned, the inhabitants plundered, abused, murdered, with impunity from the cause."

The whole situation of the United States today remained unchanged, the speaker pointed out, and the peril under existing conditions was identically what Washington said in his fifth annual address to Congress: "If we desire to avoid insult we must be able to repel it."

An appeal to the pride of every true American was then made. It was all very well, Mr. White observed, to demand that the Government remain firm in its foreign diplomatic relations, but

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it was obvious that an attitude of firmness meant nothing without the means to back it up. He referred then to the official preparedness measures. "The President asks that the regular army be increased to 142,000," he said. "There is no question that this will be done, but although 142,000 seems a great number of soldiers to put into the field at once, this land force would be barely sufficient to withstand the first shock of an invasion. One month ago the British casualties in the titanic struggle abroad were given in the official figures as 539,467. I haven't at hand anything official on the losses of the French, Russians and Italians, but the British losses alone represent an average of more than 30,000 a month. On this basis our present army would be wiped out in thirty days and our projected army in less than five months.

"It is evident, therefore, that any invasion which may come in the future will be repelled by volunteers. All of this country's wars have been won by volunteers, for that matter, but is this any assurance that we can repeat our glorious victories as we stand equipped today?

"Our sane and sensible President doesn't feel that victory will come to us through sheer patriotism alone. Only the other day he cautioned the nation to remember that: 'Modern warfare is very different from what warfare used to be. Warfare has changed so within the span of a single life that it is nothing less than brutal to send raw recruits into the trenches and into the field.'"

Attention was called to the fact that the President had asked for a great host of free men, rising as one to the call "Are you ready?" But that these men must not be mere targets for shot and shell; they must know something of the arms they have in their hands; know something of what the orders mean; men who can comprehend and easily and intelligently step into the duties of national defense.

Reference was then made to the generosity of the National Guard of New York in aiding the signal corps work proposed. Mr. White noted that armories have been placed at the disposal of the Junior American Guard and skilled officers have voluntarily come forward to supervise the training of members. This service could be given by no other body of men in like proportions, he believed; while many might offer, nowhere else could the combination of skill and available time be so readily secured.

# Army's Chief Signal Officer Now a Vice-President

**WAR DEPARTMENT**
**OFFICE OF THE CHIEF SIGNAL OFFICER**
**WASHINGTON**

*It will give me great pleasure to serve as an honorary vice-president of the National Amateur Wireless Association. I consider it a great compliment to be asked to serve with the distinguished gentlemen you mention, and I shall be glad to do whatever I can in furthering the national movement for the educational development of young men who will eventually be fitted for operators and engineers. These will be of great service to the War Department in case of emergency, and I trust you will be able, from time to time, to give me a list of such of your members who have signified their intention of volunteering for radio service in the Army in time of need.* *Sincerely yours,*

SAMUEL REBER,
*Lieut.-Col., Signal Corps.*

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"I don't propose, however, to take up your time tonight with an academic discussion of the relative values of the plans for citizen preparedness," he added. "We will let the future supply the answer. But I most emphatically do assert—and defy contradiction—that whatever the answer, it lies right in this room! Here among you young men, representatives of the patriotic youth of the nation, lies the safety of the nation. From gatherings such as this will come the soldiers of the future—citizen volunteers, militiamen, regular army officers—all will be created from material moulded at the plastic age. Time will decide which is the best method of training men, but nothing on earth is more certain than the fact that the nation is not getting ready if it overlooks preparing the boys!"

To support this statement, Colonel Glenn and General O'Ryan were quoted as saying that all wars are waged by boys from sixteen to twenty-five years of age; that history teaches that wars are fought and won by youngsters.

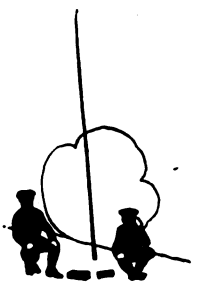
The amateurs were urged to realize that their need for military training was urgent.

"Should a crisis come tomorrow, the safeguarding of our shores lies with you!" said Mr. White. "Do you realize that? Our first line would no sooner take the field than a call would come to get the young men ready to follow.

"And it will always be so. American ideals will never permit this country to be dominated by a fighting machine. We shall have an adequate standing army and a better navy, but the reserve forces which will be depended upon eventually to turn back the tide of invasion will come from citizen defenders trained to the use of arms."

He then stated the definite object of the meeting.

"We are gathered here tonight to form a signal corps battalion, which will represent New York in the Junior American Guard. With forty companies of infantry organized, uniformed and drilling, we have need of signaling troops to make the prospective reserve ready for manœuvering under field conditions, which will begin within a few months. In calling together the local members of the National Amateur Association,



and their friends, I know I have not only brought out staunch and willing citizen soldier material, but skilled manipulators of wireless apparatus as well. The amateur wireless enthusiasts of New York City are second to none in the country, and I can assert without fear of contradiction that a similar call, made nation-wide, would bring me a thousand young men who can take any ordinary wireless set and operate it under the most adverse conditions. As members of our Association you have already been given instruction in the technical features of various types of equipment; you have been taught the construction and operation of portable sets and fixed stations; so far as the operation of apparatus is concerned, you are well equipped to take the field right now.

"But to be efficient as military units, you must undergo a long period of special training. You must know, both in theory and practice, what the commands of an officer mean, what discipline accomplishes in the field, what the execution of military orders entails. As members of the signal corps you will be thoroughly instructed in the methods and means of bringing up reinforcements, ordering ammunition and provisions forward from the supply trains, plotting a landscape, preparing and reading maps which indicate the position of enemy troops and your own forces. You will learn how to take care of your physical well-being in camp and on the march, and will be thoroughly schooled in the principles of first aid to the injured. Those among you who rise from the ranks will begin study of tactics and military strategy, will be given an opportunity to display generalship in mimic warfare, where you will be opposed by other troops of the same organization. All the work will be thoroughly practical,

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because at the outset it will be directed by experienced officers, and later will be continued by those who have acquired in the ranks the knowledge which will entitle them to leadership."

Emphasis was laid on the fact that members who have followed the Association's teachings are no longer novices: "They can build, and do build, wireless equipments which could actually be used in military field work. Furthermore, study has trained the minds of members; they know how to think, know how to concentrate on problems; consequently they are certain to prove highly efficient in military work when they take it up.

"We are not dealing with children when we consider them as defenders of the nation," said Mr. White. "Before I came here tonight I had an age analysis of the first thousand members drawn. Only a half dozen had not reached their 'teens; the heaviest representation centered in the ages between sixteen and nineteen; more than thirty-five per cent. were over twenty-one, and our oldest member has reached the silvery age of sixty-five.

"With our peak load at age sixteen, we have a valuable nucleus for signal corps training; this is the best period of a lifetime to take up serious study; the playfulness of the youngster has been left behind and the thoughts are turning to the serious obligations of manhood. Here is material for the signal corps ranks that cannot be equalled; here are young men who will be willing and anxious to acquire military knowledge in the two years before they are eligible to officers' commissions in the Junior American Guard. Here we have our officers of the future.

"In the analysis referred to ages eighteen to thirty-five included just about half of the thousand—the best possible material for immediate use as subordinate officers.

"Commanders have already been supplied through the generosity of the National Guard. All we now await is enrollment, the purpose of our meeting tonight."

Mr. White then said he felt that with some proportion of the audience he thought had arisen: Why had he confined himself to the warlike aspects of the movement? Why had not some mention been made of the other benefits to be secured through training along military lines—the value of drilling as a means of building up the boy mentally, morally and physically. He answered this unspoken thought with the observation: "I have refrained from extended mention of these features for two reasons: the first, because I know you are all intelligent enough to appreciate and value them for their obvious advantages; the second, because I feel it my duty as an American citizen to urge you toward preparedness in event of war. The second reason so far dominates the first that I am inclined to use it as a sole inducement to join with us in this patriotic movement.

"Ideal and commendable as peace plans may be, you may feel certain that wars will continue. The dawn of universal peace is a long way off. But even if it were near, would that warrant our nation remaining unarmed? You can't keep order, cannot insist upon holding other nations accountable, unless you can make good. The protest of a weak nation doesn't mean much; to speak of accountability without means of enforcement will never make this a better world.

"Firmness and justice to all is the ideal upon which the whole American nation is founded. We wish to spread that gospel all over the civilized globe. To have our words and rights respected we must be able to enforce them when necessary. Neutrality means maintenance of duty. Defense of America's policy of neutrality brought on the war of 1812—may bring upon us another war; for the maintenance of neutrality depends upon force to defend that policy when it is attacked. America will always be neutral in spirit, therefore Americans must be ready to uphold the duties of neutrality.

"In organizing signal corps battalions,

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the National Amateur Wireless Association expects to teach Americans what it means to be a citizen of a free country; hopes to bring in an interesting way before the youth of the nation the clear fact that it is their duty to take up arms for national defense if their country needs them. It further proposes to aid in correcting a great national abuse of the flower of the nation—the sending to slaughter of heroic volunteers, who in the wars of the past haven't had an equal chance with their foes because they were unprepared for the rigors of the campaign. All of this country's wars have been fought and won by volunteers, and under the ideals of the nation, citizen soldiers will continue to bear the burdens of the future. The regular army and the navy are designed to withstand only the first shock of invasion. And, as I have shown in the British casualty figures, the army, brought up to its full strength, would be out of action within five months after meeting at grips with a powerful adversary.

"It takes two years to make a soldier. Our first line is not designed to hold that long. To rush reinforcements to its support requires a trained reserve, prepared for action and capable of prompt mobilization. We *must* have a prepared reserve. Patriots by the million can be counted upon to swell our ranks at the first sign of danger, but it will be on our national conscience if we again send our heroic defenders to certain death because they are not trained.

"And we must have officers to lead these men. The nation must be made to insist upon leaders who understand the problems they are called upon to face. We must not depend upon hurried training; we must not endanger the lives of our finest citizens by placing them under officers whose experience is gained in beleagured camps; nor can we tolerate the thought of faltering decisions made in the smoke and thunder of the battlefield. We must not allow the safety of thousands of heroic fighting men to depend upon the transmission of the commanding general's orders at hands of a novice. If there is any choice in the matter of getting troops prepared in order, by all means have the signaling branches of the service ready first.

"Now this is my appeal to you:

"I want men who will take the military training we offer, I want material to be moulded into officers; I want true patriots who will faithfully give what little time we ask for, to prepare themselves as signal corps experts. I am asking for spirited young Americans to enroll in the battalion which will represent New York; some to swell the ranks of the one radio company which is already organized and drilling, others to form themselves into a second company to complete the battalion. There are no dues to be paid to headquarters—no obligations but faithful attendance on drill nights and the loyalty and patriotism which inspires determination to become efficient defense units for the safeguarding of the nation.

"I ask that New York show the way to the rest of the country; set an example which will extend the movement throughout the length and breadth of the nation."

The response which marked the conclusion of the speech was generous. It developed as enrollments were made that several experienced militia men were in the audience and a request was made that a committee be appointed to acquaint the members who had not been able to attend with the proceedings of the evening. This committee has since reported to headquarters that several hundred New Yorkers who were unable to attend have made a special request that another meeting be held, among these are a half dozen operators who have had military experience, and wish to submit their qualifications to serve as instructors. A canvass of those making the petition is to be made with a view of selecting the time and place most convenient to all concerned.

## ALEXANDERSON ADDRESSES INSTITUTE

At the meeting of the American Institute of Radio Engineers, held at Columbia University, February 2, E. F. W. Alexanderson delivered a lecture on the magnetic control of powerful high-frequency alternators by means of a small controller of his own design and a vacuum bulb.

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# An Oscillation Transformer of Unique Design

By Charles Horton

IN the construction of oscillation transformers in the early days of wireless telegraphy, round wire was most generally used, probably on account of the fact that conductors of any other cross-section were hard to obtain and also, owing perhaps to the fact that in their detailed perfection of wireless apparatus, wireless engineers had not yet taken up this instrument. When attention was finally focused on the transformer various changes were made. It was found that area for area a flat conductor has more surface area than a round one, which fact had the effect of causing the elimination of the round wire and the adoption of the flat strip. Now the only flat strip to be readily obtained was, of course, a strip with straight edges which necessitated that the strip be wound into helices in such a way that its lateral dimension was parallel to the longitudinal dimension of the helix; that is flat on a cylindrical form.

But in the use of these helices it became apparent that there was considerable brushing between the turns, caused by the sharp, narrow edges of the metal strip, and consequent lowering of efficiency. Furthermore, it was evident that on account of the strip having its width parallel to the axis of the helix, close winding could not be obtained with sufficient air-space, and consequently sufficient inductance meant large coils. So, in order to overcome these disadvantages and still retain the large surface area of the strip conductor, the edgewise-wound strip was developed. This type of conductor has its transverse or narrow dimension parallel to the axis of the helix and thus the turns can be made very close; and on account of the large flat surfaces presented by one turn to another, brushing is to a large extent eliminated and neat, compact coils are obtained.

It has been the ambition of amateurs in wireless to make helices of the edgewise-wound type for their own stations, but the edgewise bending of the metal strip presented difficulties which could not be surmounted except by the construction of a costly bending machine.

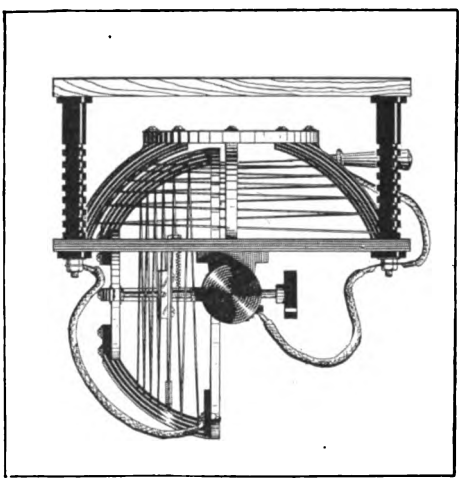

*Fig. 1*

In considering this problem the writer developed a type of transformer coil which can be cut from a flat plate and has the advantage of being edgewise wound; it has additional advantage in that the helices are semi-spherical and consequently rotary adjustment of coupling is made possible. The instrument is of that type which is intended to be mounted on the transmitting panel, on which are also mounted the condensers, aerial loading helix, etc.

Reference to Fig. 1 of the drawings



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will give a clear idea of the appearance of the instrument when mounted on the transmitting panel viewed from above. There is provided a wood base which is screwed to the transmitting panel and on which the transformer proper is mounted, being supported thereon and insulated therefrom by the

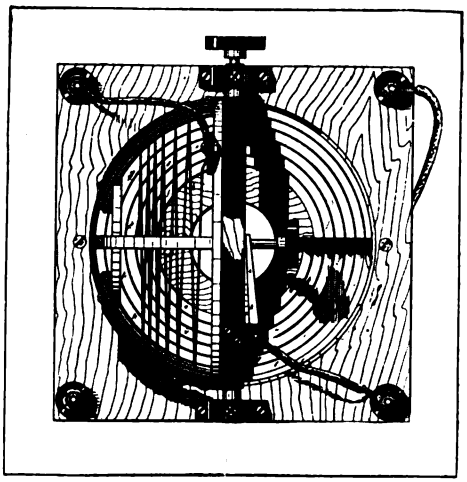

*Fig. 2*

corrugated, hard rubber posts. On these posts is mounted a second wood panel having a circular opening therein and supporting four hard rubber, arc-shaped pieces which serve to mount the primary helix. Adjustment of the number of active turns is made by the usual contact clips, of which, in this case, there are two, one being shown in Fig. 1.

The secondary is mounted on the primary panel in metal bearings and is constructed similarly to the primary, except that in this case, the adjustment of inductance is continuous and is made by means of a metal follower which rides along the inside of the helix and is controlled by the smaller of the hard rubber knobs. Adjustment of the coupling is obtained by the rotation of one helix in and out of the plane of the other and is controlled by the large knob. Set screws are provided for retaining any degree of coupling.

The fastening nuts at the outer ends of the hard rubber columns are also used as anchorages for the several flexible leads, two for the primary leads and two for the secondary leads. If desired, the hard rubber columns may be made hollow and a rod passed through each one to carry the connections through to the back of the transmitting panel, thus making a very neat arrangement.

Reference to Figs. 2 and 3 will serve to show various parts in other views; Fig. 2 being a view taken from the front of the panel and showing, among other things, the brush contact to the primary slider. Fig 3 is a view of the instrument taken from the right side, in which the primary helix has been removed and the supporting members of the primary cut in the middle to show the arrangement of the secondary helix and supports.

In the construction of the transformer, oak is suggested as the best wood to be used. It should be stained very dark brown and finished with floor polishing wax.

Referring now to the detail drawings:

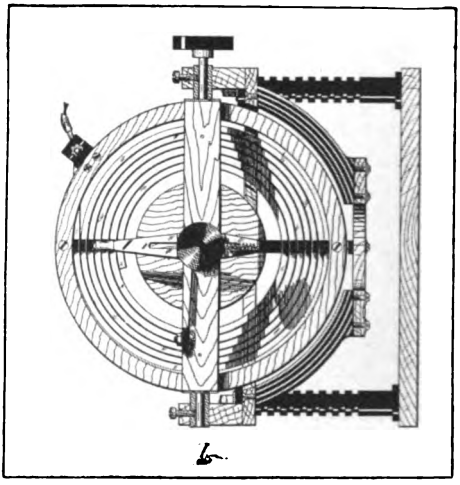

*Fig. 3*

Detail No. 1 is the wood back or base piece which should be of ¾ of an inch stock and perfectly true as this is the foundation for the entire instrument. Holes are drilled in the corners, as shown, for ⅜ of an inch flat head brass machine screws to mount the columns. Detail No. 2 is the top panel which is mounted on top of the columns and supports the primary helix. The large circular opening shown is bevelled to agree with the helix supporting pieces,

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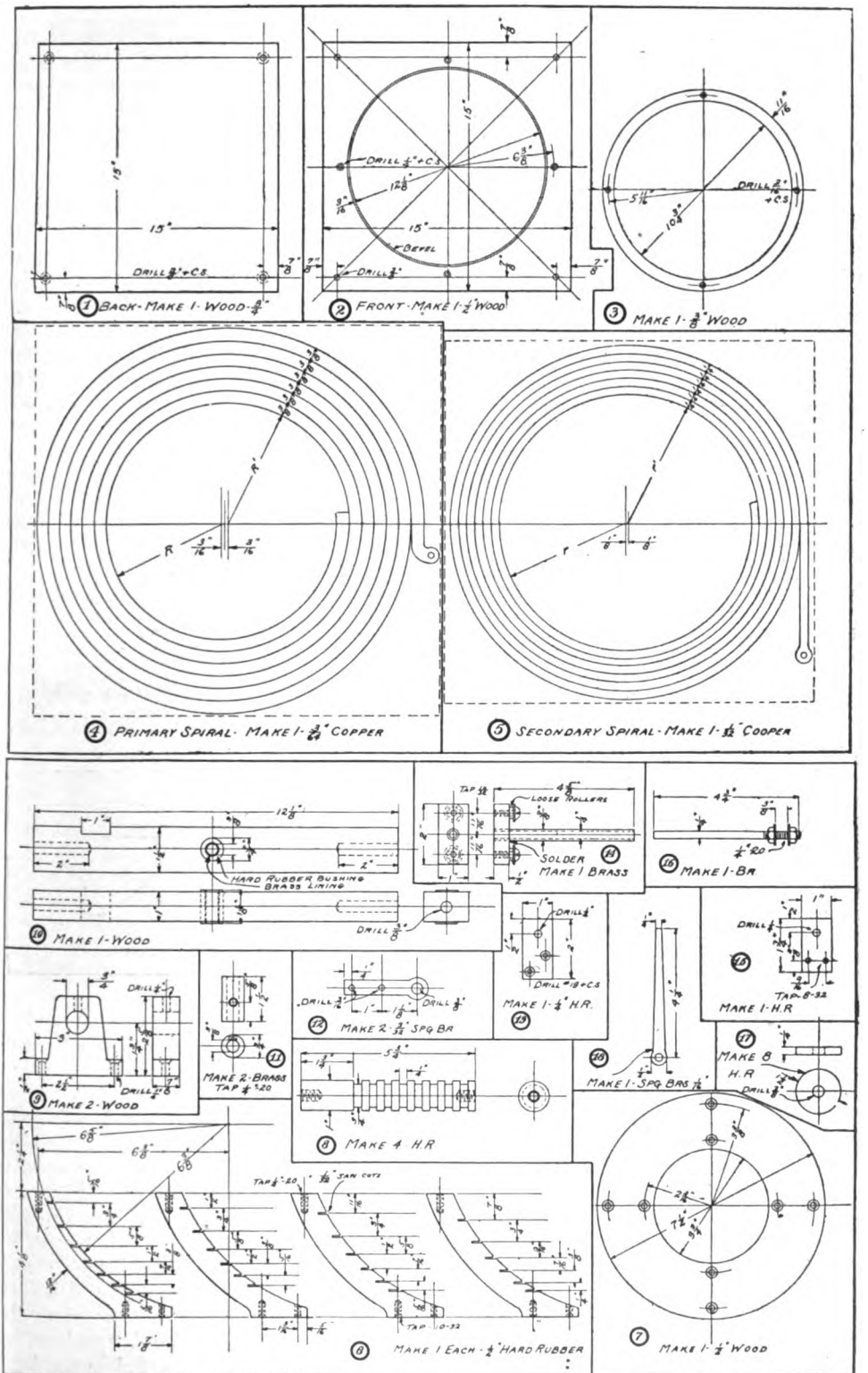
1 BACK · MAKE 1 · WOOD · 3/8"
2 FRONT · MAKE 1 · 1/2" WOOD
3 MAKE 1 · 3/8" WOOD
4 PRIMARY SPIRAL · MAKE 1 · 3/64" COPPER
5 SECONDARY SPIRAL · MAKE 1 · 1/32" COOPER
6 MAKE 4 H.R.
7 MAKE 1 · 1/2" WOOD
8 MAKE 1 EACH · 1/4" HARD RUBBER
9 MAKE 2 · WOOD
10 MAKE 1 · WOOD
11 MAKE 2 · BRASS
12 MAKE 2 · 3/4" SPQ. BR.
13 MAKE 1 · 1/4" H.R.
14 SOLDER MAKE 1 BRASS
15 MAKE 1 · BR.
16 MAKE 1 · SPQ. BRS 1/4"
17 MAKE 8 H.R.
18 MAKE 1 · H.R.
HARD RUBBER BUSHING
BRASS LINING
LOOSE ROLLERS

*Detail Drawings*

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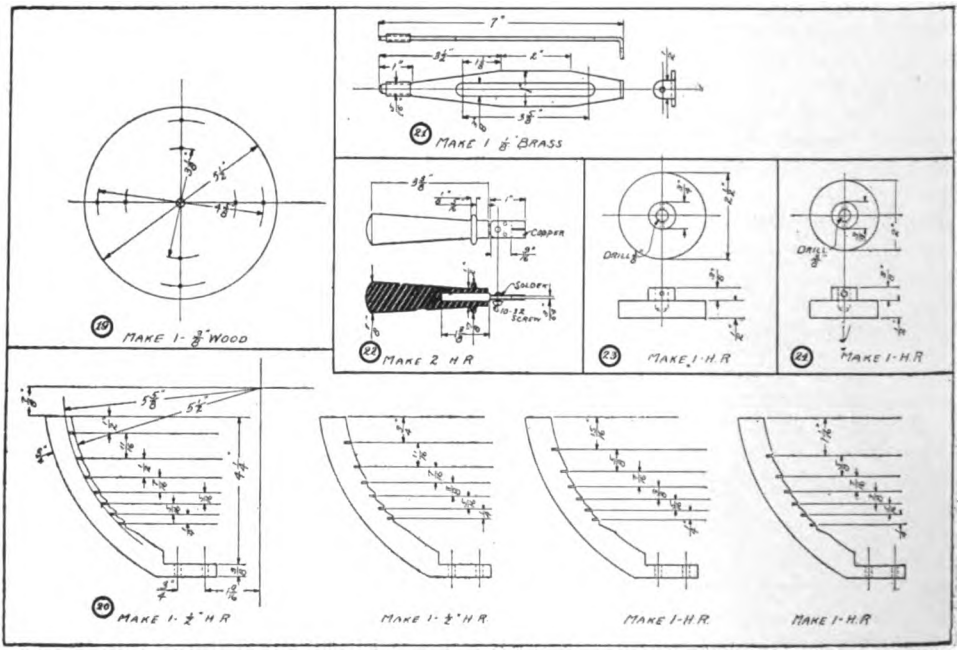
in order to give a neat appearance. Detail No. 3 is the wood ring which supports the secondary helix supporting members and is carefully made as shown, care being taken to prevent warping. Detail No. 4 is the primary helix proper and shows the method of laying out the helix. A piece of 3/64-inch copper wire, 12½ by 11¾ inches, is secured and a half circle drawn with a radius of 6 inches close to the left hand side. Then, with the same center and using radii ⅜ of an inch less each time, six other half circles are struck within the first. Next, a center is found in the same diameter as before and a radius of 5 13/16 inches is taken; a half circle is drawn below the first group, joining the left-hand end of the first half circle, to the right hand end of the second half circle. Then using the same center and radii successively ⅜ of an inch shorter, draw the remaining six half circles, thus completing a spiral of a width of ⅜ of an inch. The helix is now cut out with a pair of metal shears, care being taken to prevent the strip cut from losing its flatness. This done, the helix is hammered flat if necessary with a wood mallet and laid aside.

The secondary helix, detail No. 5, is made similarly from a piece of 1/32-inch copper sheet, 11⅛ inches by 11 inches, but the helix is in this case only ¼ of an inch wide. Detail No. 6 shows the primary helix supports and should be cut from half-inch hard rubber or fibre exactly as shown. Hard rubber should be used unless it is too expensive; in that event fibre may be substituted. When mounted on the top panel (detail No. 2) these pieces should be mounted in the order in which they are drawn so as to insure proper form for the helix. Detail No. 7 is the connecting disk for the other ends of the pieces just described and should be perfectly true. Detail No. 8 is the hard rubber columns which should be turned as shown and polished. Detail No. 9 shows the supports of the bearings for the secondary helix form. Detail No. 10 is the mounting piece for the secondary helix form. Pieces of ⅜ of an inch brass rod are to be pinned in each end for bearings. The hard rubber bushing in the middle is to insulate the slider shaft from the wood and is lined with brass to insure easy rotation. Detail No. 11 shows the brass bearings proper which are mounted in the bear-




*Detail Drawings*

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ing pieces, 9. Detail No. 12 shows the friction springs intended to be mounted between the mounting piece, 10, and the bushings, 9, at each end, in order to cause the secondary to rotate under friction.

Detail No. 13 shows the insulating support for the end of the primary helix. Detail No. 14 is the main part of the secondary slider. Its construction and action will be evident from an examination of the drawings. Detail No. 15 is the insulating support for the end of the secondary helix. Detail No. 16 is the rod on which the slider head, 14, slides and rotates and is mounted at the center of the secondary form supporting disk, to be described, by means of the nuts and washers shown. Detail No. 17 is the hard rubber washers for the tops and bottoms of the columns. Detail No. 18 is the contact spring for the secondary slider shaft. Detail No. 19 is the secondary form supporting the disk mentioned.

Detail No. 20, is the secondary helix supporting members and should be made exactly as shown of ½-inch rubber. The peculiar outline on the inside of the pieces is caused by filing away the rubber near the turns of the helix to permit the slider to pass. This is done after the secondary helix is assembled in its form. Detail No. 21 is the slider proper and is intended to slide on the loose rollers on the block-piece of detail No. 14. On the left hand of the same is forced a piece of soft rubber tube to prevent brush discharge to adjacent turns.

Detail No. 22 shows the primary contact clips which are made exactly as shown, the flexible leads being connected thereto by means of the 10-32 screw specified. Detail No. 23 is the knob for the adjustment of coupling and is made entirely of hard rubber to permit handling when the set is in operation. It is attached to its shaft by means of a pin extending entirely through its hub. Detail No. 24 is the knob for the adjustment of secondary inductance and is made as above.

When this transformer is carefully made and assembled it presents an excellent appearance and is quite effective in operation. It is designed particularly for ¼-kw. sets. The secondary does not have as many turns as usual and a loading coil may be used when a longer wave is desired.

## Direction Finder Experiments

The United States Government is conducting a series of experiments at the Radio Station, North Turo, Massachusetts, to perfect the Bellini Tosi Direction Finder. The purpose of the instrument, as explained in previous issues of THE WIRELESS AGE, is to enable navigators to send signals to the shore station and from it receive their ships' bearing.

The method of finding a vessel's bearing, as at present used, consists of a call to the North Turo station, and request for her position. North Turo acknowledges and requests the ship to send long dashes for five minutes on the 600-meter wave-length. North Turo will then record the direction on the finder and report it to the ship. As the station is on the point of Cape Cod, a ship may be on either side of the cape for the same setting of the instrument; the ship is, therefore, given the two possible angles from the true north, the decision being left to the ship as to which is her correct bearing.

## Professor Zenneck on Problems

At the meeting of the Radio Club of America held at Columbia University on February 18, Professor J. Zenneck, of the Technical College. Danzig, delivered an interesting lecture on "Some Problems of Wireless Telegraphy." He discussed especially spark systems and methods of continuous sending, and the use and limitations of the various forms of detectors in the measurement of amplitude of vibrations.

Following Professor Zenneck's lecture, Dr. John Stone Stone urged an effort to secure a more liberal treatment of amateurs by the government in the matter of wave-lengths permitted, and suggested that originators of heavy traffic and steamship lines be assigned special wave-lengths to prevent the present interference on 600 meters.

Fritz Lowestein and E. J. Simon also made remarks. At the close of the discussion Professor Zenneck was made an honorary member of the Club.

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# How Wireless is Being Used in the War

**By A British Army Officer**

**Editor's Note—Owing to conditions which are at once obvious, it is necessary to keep sceret the identity of the author of this article. The publishers of this magazine wish to go on record, however, with the statement that he is a British army officer of high rank who has been at the front since the war began. The points which he makes about wartime wireless are all the result of personal observation, and what he claims in regard to the revolutionizing of methods of wireless signaling is, to use his own words, "common knowledge at the Allies' front and of course to be known the world over when the war shall end." The manuscript, perhaps the most unusual one thus far published in this country, reached THE WIRELESS AGE under conditions which absolutely verify its authenticity.**

NOT until this war is over can the full measure of the priceless service rendered by the wireless be made known in all its details. It can be easily understood that at this time it is impossible to give more than the most vague hints of the improvements which have been made in the art and science of wireless telegraphy, but this much at least is certain—

*After the war is over, if not before, there will be given to the world improvements which will practically revolutionize wireless work and will open up possibilities not even now dreamed of by the unitiated.*

And to Marconi, for his intense devotion to the Cause for which he is fighting, for his wonderful, tireless work and for his ceaseless efforts to improve what has already been done, will come much deserved honor.

I HOPE I shall be forgiven for referring so off-handedly to the inventor as "Marconi," but it seems to me that one could no more give him a formal prefix than to Washington, Lincoln, Garibaldi, Edison, or any of the men who have done so much for their countries—and the world. As a matter of fact, I don't know his first name, or even his official or military title. I only know what he has done and what his inventions are now doing for the Allied Forces.

I wish it were possible to tell you just what is being done with wireless at the Front right now—but it is impossible. I can only mention those thing which are already known; but perhaps the fact that what I write is of personal observation, may render it of some interest.

When the war broke out, army wireless operators—competent and capable men who really knew their business—were as few in numbers as were the rest of those we so sorely needed. Luckily, however, there were many who had



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taken up the art for the pure love of the thing, and they were quick to volunteer. Telegraph operators of the Postal Department were soon broken in to wireless work, so that it was not long before we had a good and very efficient force in the field.

*In a Belgian village near King Albert's headquarters, wires are run from the spire of a church down to a limousine automobile, elevated on piles of brick, which generates the power for the wireless system*

The first time I saw a wireless operator at work was just outside Poperinghe, about five miles behind Ypres. An observation balloon was going up and into the little car below the great gas-bag climbed a young chap carrying a headpiece and a mess of wires attached to a small box. I was told he was the wireless operator and I stopped to watch his work.

In the field below the balloon was a motor car with a pole above it with wires extending downwards to the ground. (Please understand that as far as regards wireless technicalities I am very much of a layman, knowing nothing of the correct terms.)

The balloon, looking like nothing so much, in color and shape as a gigantic banana, finally reached the desired height and then the wireless machine in the car started to snap and spark, the operator writing and passing his sheets from time to time to the officer standing beside him. I learned that as the observing officer in the balloon located certain positions he gave the information to the operator who, in turn, transmitted it to the man below. Below the balloon's car trailed wires about forty feet long and these, I was told, had something of the function of the ground wires of a stationary equipment.

The balloon, carried by the winds and held to earth by the cable which attached it to a powerful motor truck—looking like nothing so much as a big, fat woman hauling a pomeranian along on a leash—drifted away a mile or so towards Ypres. Still the ceaseless flash and chatter of the

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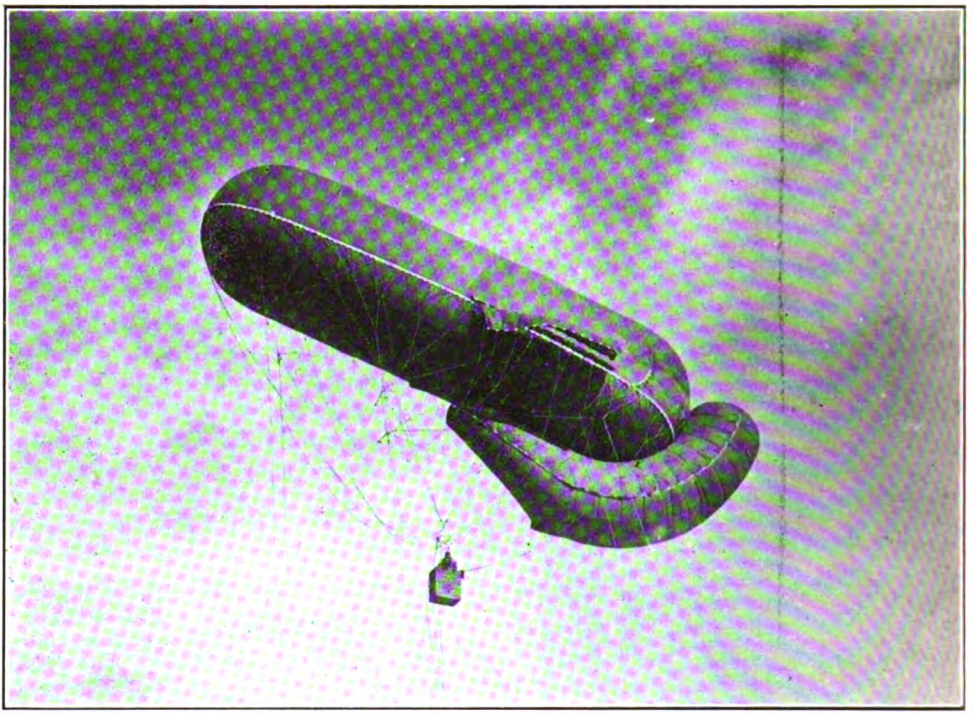

*In an observation balloon near Ypres. The operator is signalling information to a station on the earth. Notice the antenna wires trailing below the balloon's car*

instruments kept up and at last I was impelled to ask the question:

"Why not a telephone line to the ground instead?"

With a pitying smile the expert told me that a telephone line was not anyway near as good because it would need many men to follow along with it and see that it did not catch in the trees, when it would be easily broken.

"Besides," said my informant, "if the bally gasbag breaks loose and drifts over the German lines the operator can keep in touch to the last minute, don't you see."

And I learned later that this had happened on one occasion and that the operator had "kept in touch." The "last minute" was when the balloon was exploded by a shell!

When attached to the Belgian Army for certain purposes which it is not necessary to mention here, it was part of my duty to visit the little village behind the lines where King Albert had his official headquarters. He was located in the house of the Curé of the parish, a beautiful old mansion surrounded by a moat. Right beside it was the church and from its tower ran wires to the ground. In front of it was a very fine limousine automobile which I was told used up many gallons of petrol (gasoline) a day, but never made as much as a mile a week. When I asked why, I was shown that it was elevated on piles of brick so that the wheels did not touch the ground, its motor was used to generate the power for the wireless system. This, I may say, is the way power is obtained for the field outfits, the engine of the motor field equipments being so constructed that when the car is at rest—and in some cases, when in motion—it can be used for wireless work.

While every division is connected with General Headquarters by endless numbers of telephone and telegraph lines, the wireless plays an important and indispensable part. From the headquarters of each division also, the air carries messages to the regiments ahead. Out as far as the front line of trenches the wireless operators are at work sending back their

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*A French wireless station in operation in the vicinity of Saloniki. The operators are keeping in touch with the units of an aviation corps during an engagement*

messages. And in the casualty lists are the names of many wireless operators whose epitaph is "Died on the field of honor."

The telephone and telegraph have, of course, played an important part in this war. Their lines are by no means "laid in pleasant places"—and bad as this joke is, it is not so bad as the reality. I have seen them at work under the most trying conditions and have never ceased to admire their pluck and daring. During the many bombardments of Ypres I saw them time and again dash along a road which was being shelled with shrapnel and high-explosive and, under a fire which was worse to face than the most vivid imagination could picture, tie up the broken wires.

A dozen men have gone out, one after the other, from a communication trench to tie up the line from the observation artillery officer to the guns in the rear — and the twelfth man only has crawled back torn by shell or wounded by bullet. BUT—the line was tied and communication established.

*Italian engineers repairing telegraph and telephone lines which were destroyed by the Austrians. These land lines are used as an adjunct to the wireless system at the front*

Much of this loss has been reduced by the use of wireless and I believe that under present and future improvements it will be still further diminished. And that brings up the question of the importance of having a sufficient number of *properly trained* and competent men to take over this kind of work when needed.

My experience has been—and I can positively declare that it is within the knowledge of every officer who has served in this war—that the amateur, no matter how loyal, how eager to serve his country, or how competent in the tech-

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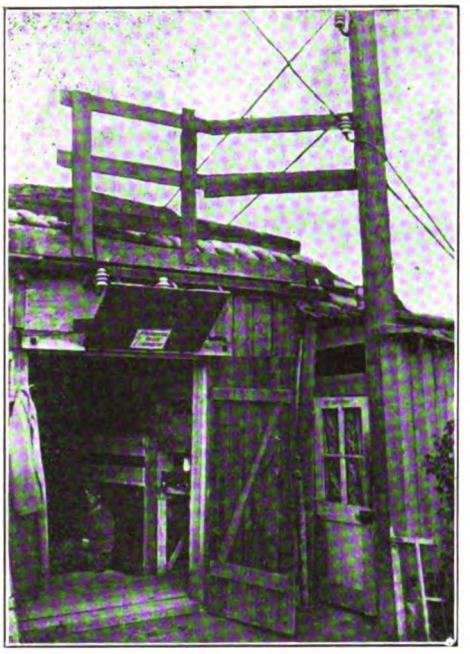


*Electric power station in the trenches. These stations are often used for transmitting power to the wireless installations*

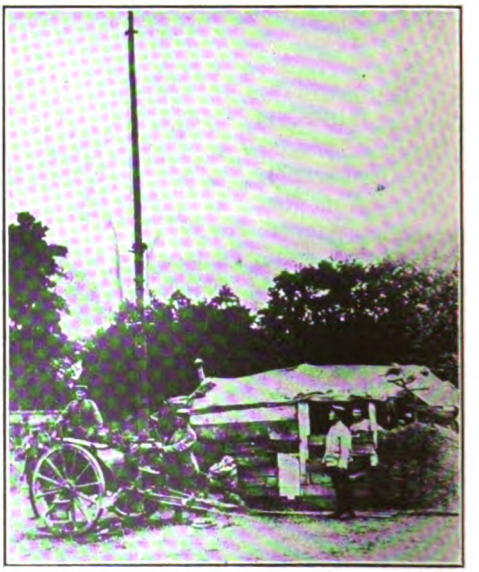
nical work of his particular line, is useless for military purposes until he has received and absorbed the routine, the methods and the discipline of the army. It is not merely knowing the *work;* it is knowing how to see that the work is done, knowing how to give those with you confidence in you so that they will do the work, knowing how to give an order—*or take one*—knowing how to meet an emergency—and overcome it. And only training, on practical lines, can give this.

Give me the choice between the gifted, enthusiastic but untrained amateur and the man who has much less science and skill but who has had a few months' training—and I'll take the latter every time if I have a job to carry through which needs a cool head and quick thinking. It is only possible to realize the difference when you have seen how men are changed over with just two or three months in camp.

But to get back to the wireless: I will never forget how I got the news of the Lusitania's sinking. I was in a little village on the outskirts of Ypres and there was a wireless station next to the house where I was billeted. I had been in the habit of going over when I had the chance to talk to the operator and get what news he was picking up. Watching the sparks flying, I was absorbed in my thoughts, when he broke in with the news of the disaster. He got it from the air as it was being flashed across to England from an Irish station and thus we at the front knew it before the public of England or America did.

Of course, the wireless method of communication has been used for ulterior purposes. Only after the war is over will it be possible to tell openly of the many wireless plants which have been discovered giving information to the enemy. In one town on the front it was necessary to practically demolish every house in order to stop the activities of a wireless plant which was sending out priceless information and which could not be located. Below Dixmude, on the Belgian coast, a mill was discovered with a fine installation in it and, on the other hand, much valuable information for us was stopped because the other side found a plant which had been operating with much success in Ostende for the Allies.

Regarding the usefulness of theoreti-



*German wireless telegraph with a portable mast in operation*

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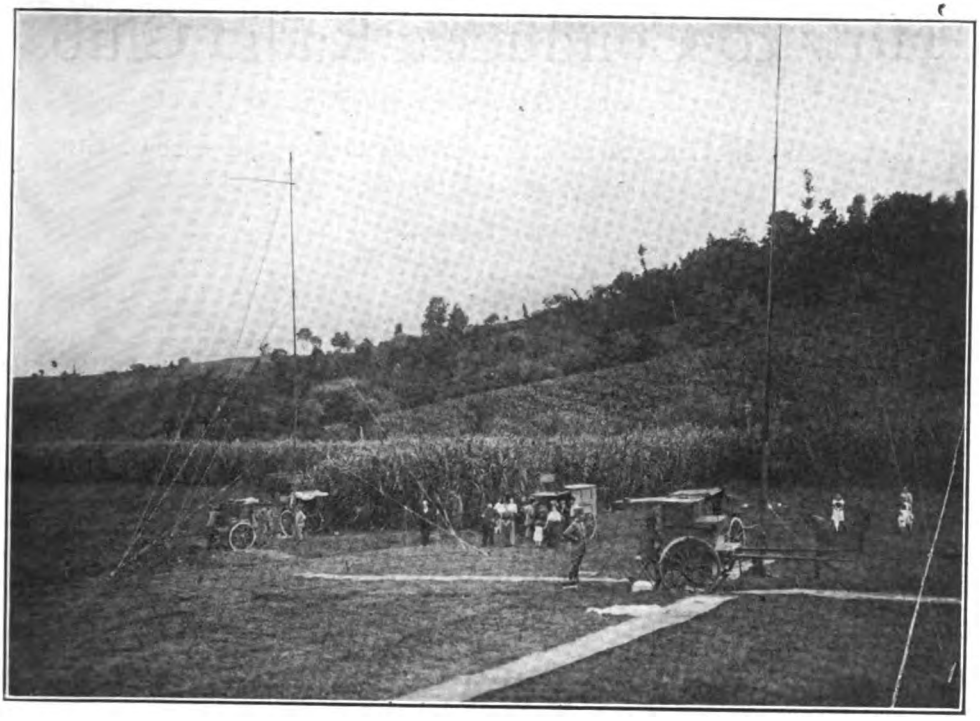

*An Italian wireless field station. This photograph shows how the portable equipment is being employed in the European war*

cal and field training for actual work much, of course, will be learned from this war. Nothing which teaches a man to stand on his feet and accept responsibility is useless; that goes without saying. Nevertheless, I fancy that much which is being taught now will be changed later on. For instance:

There is, I understand, a method of keeping up communications of portable wireless units which is known as the "leap-frog." By this, units A. B. and C. go out. When A. moves forward, C. theoretically leaps over B, into his place and, subsequently, B. takes A.'s place on the next move, and so on, the last man taking the place of the foremost man at each move. All men are, of course, keeping in touch with each other and with Divisional Headquarters or base.

Well, by experience, I should say that under fire this would not be practical. If a shrapnel or high-explosive shell, with a killing radius of 30 to 50 feet, should wipe out one of these units, it would destroy the forward connection and, unless the officer commanding was unhurt and in touch with all units some confusion would possibly arise. The best method, as I understand, has been to have the units scattered along an equal front and, as in skirmishing order, fill up whatever gaps are made by drawing closer together. This, of course, is merely given to illustrate what is done and is not officially authoritative.

In conclusion, I can but repeat that following this war there will be much of interest and value given to the world regarding the wonders of wireless communication. In many methods there will be what will practically amount to a revolution and much that is now accepted as standard will be discarded. It has taken this practical test to demonstrate how much is useless and how many former theories are now practical. One thing, however, is sure and that is:

As the aeroplane has been proven to be the eyes of an army, so in an even greater degree has the wireless gained the right to be called "The Ears of the World."

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# How to Conduct a Radio Club

*(Specially Prepared for the National Amateur Wireless Association)*

## Elementary Instructions for the Construction and Use of the Wave-Meter

**By Elmer E. Bucher**

**ARTICLE XXI**

AN essential, but seldom found piece of apparatus at the average amateur station is a wave-meter for calibration of the transmitting and receiving circuits to resonance or to a definite value of wave-length. Many of the problems of the radio experimenter could be immediately solved if he would purchase or construct a wave-meter of suitable range and determine for himself whether or not his apparatus or aerial system complies with the United States restrictions. It is not a difficult matter to construct a wave-meter for amateurs' use but unless a calibrated instrument is available for comparison, it will be of no value to the designer.

Experimental determinations were recently made with a home-made wave-meter comprising a Mesco condenser No. 294, designed to have a maximum value of capacity of .001 of a microfarad connected in series with an inductance coil having forty-six turns of No. 16 single silk covered wire, wound on a hard rubber tube exactly 6½ inches in diameter. Two leads, 12 inches in length were extended from the coil of inductance to the terminals of the condenser. A crystalline detector, connected unilaterally, as shown in Fig. 1, was employed for determination of the point of resonance. At the zero position of the condenser scale the wave-length of the circuit was found to be 185 meters, and at the 180 degree position, 1,040 meters. It will then be observed that a meter of this range is quite suitable for calibration purposes between 200 and 800 meters. A complete table of wave-lengths for the entire scale of the condenser is tabulated as follows:

**Table No. 1**

| Degrees of Condenser Scale | Corresponding Value of Wave-Length |
|---|---|
| 0 | 185 |
| 10 | 225 |
| 20 | 325 |
| 30 | 380 |
| 40 | 465 |
| 50 | 530 |
| 60 | 580 |
| 70 | 630 |
| 80 | 670 |
| 90 | 710 |
| 100 | 760 |
| 110 | 825 |
| 120 | 840 |
| 130 | 890 |
| 140 | 915 |
| 150 | 930 |
| 160 | 980 |
| 170 | 1,000 |
| 180 | 1,040 |

The foregoing data plotted in curve form appears in Fig. 2, from which the intermediate values corresponding to the intervening degrees of the condenser scale may readily be obtained.

For good signals in the head telephones, with the unilateral connection, a sensitive crystal, such as galena or cerusite must be used and, if very loud signals are required, one terminal of the condenser should be connected to the grid of a sensitive vacuum valve. (Fig. 1.)

### A Wave-Meter of Lower Range

Another coil of wire comprising twenty-two turns of No. 16 single silk covered wire wound on an insulating tube of hard rubber 6½ inches in diameter with two extended leads each 12 inches in length, gave the following values of wave-length when connected in shunt to the small Murdock vari-



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able condenser No. 368. This condenser has a maximum value of ca-

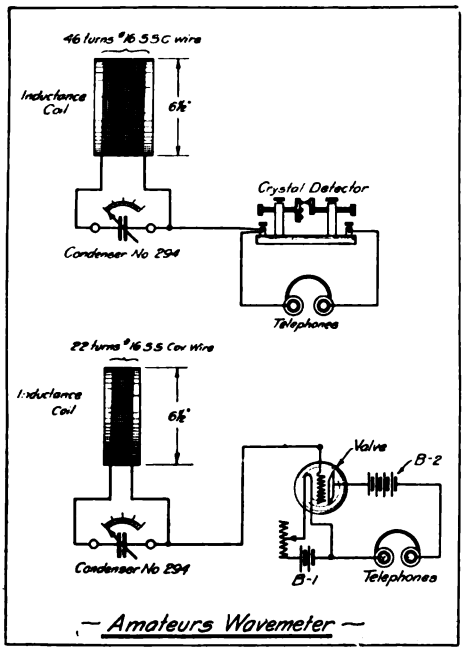


*Fig. 1*

pacity of .0005 of a microfarad. The data follows:

**Table No. 2**

| Degrees of Condenser Scale | Corresponding Value of Wave-Length |
|---|---|
| 0 | 140 |
| 10 | 160 |
| 20 | 195 |
| 30 | 235 |
| 40 | 260 |
| 60 | 300 |
| 80 | 340 |
| 100 | 365 |
| 120 | 400 |
| 140 | 440 |
| 160 | 470 |
| 180 | 500 |

It cannot be expected that several of these condensers will check up identically, but if the coil of wire of the dimensions given is used, a reasonable degree of accuracy can be expected rendering it unnecessary for the experimenter to work out elaborate formulae for the computation of the wave-length.

The data given in table No. 2 is depicted in the curve. (Fig. 3.)

After either wave-meter has been constructed in accordance with the foregoing instructions, it is important to understand thoroughly the manner in which the instrument is to be used. Suppose, for example, it is desired to measure the fundamental or natural wave-length of a transmitting aerial to find out whether it complies with the restrictions: The complete procedure is shown diagramatically in Fig. 4. The aerial wires are represented at A, the earth connection at E, a small spark gap connected in series at S-2 and the secondary terminals of a small induction coil at S-1. The inductance coil of the wave-meter is indicated at L, the small variable condenser at C, the crystalline detector at D and the head-telephones at P.

The circuit to the primary winding of the induction coil is closed and the length of the spark gap carefully adjusted until a clear spark note, free from arcing, is obtained. The inductance coil, L, is placed in proximity to the earth lead from the spark gap S-2, and careful adjustment made of the detector, D. The small condenser, C, is then altered in capacity and if the natural wave-length of the antenna is within range of the scale of wave-lengths on the wave-meter, a point will

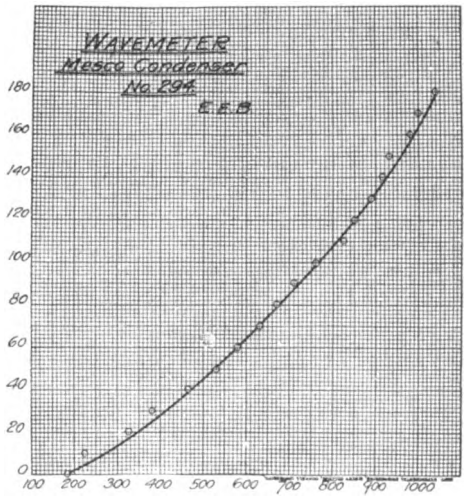


*Fig. 2*

be located where loud signals are obtained in the head telephones. This

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indicates that the circuits of the wave-meter are in resonance with the antenna system and by reference to the table of wave-lengths corresponding to the degrees on the variable condenser the required reading is quickly obtained.

If the point of resonance is not well defined and the signals can be heard over a considerable number of degrees on the scale, the coil, L, should be moved to a distance from the earth lead until the signals are barely audible. In this manner sharper readings on the scale of the condenser are obtained. If a humming sound is heard in the head telephones over the entire scale of the variable condenser, it indicates that the wave-meter is not of suitable range for the antenna system and therefore one of greater (or possibly lesser) range will have to be constructed.

Should the measurement made as in Fig. 4 indicate that the fundamental wave-length of the aerial system is in excess of 200 meters, the value may be reduced either by decreasing the length of the flat top portion of the antenna or by connecting three or four small condenser plates (connected in series with each other) in series with the aerial system. By proper selection of capacity, the natural wave-length of the aerial may readily be reduced to 200 meters.

If an oscillation transformer is used to transfer the energy from the spark gap circuit to the aerial wires, as indicated in Fig. 5, and a close degree of coupling is employed between the primary and secondary windings, the emitted wave from the aerial wires is apt to be broad, *i. e.*, the aerial wires may radiate two waves one of which is far in excess of 200 meters. In this case if the wave-meter is placed in close inductive relation to the earth lead and the spark caused to discharge across the gap, two points will be found on the condenser scale where the signals are audible.

But if the primary and secondary windings, L-1 and L-2, respectively, (Fig. 5) are drawn apart, the two points of resonance will come nearer on the condenser scale until finally but one sharp point of resonance is located. The emitted wave from the aerial wires is now said to be "pure" and if the decrement of damping is less than 2, the requirements of the government regulation are fully met.

In a similar manner the amateur may measure the wave-length of the spark gap circuit as shown in Fig. 6 and then subtract or add turns at the coil, L-1, or increase or decrease the size of the condenser bank until the wave-length of the closed circuit is in complete resonance with the aerial wires.

Excited by a buzzer and used as a small radio transmitter, the wave-meter

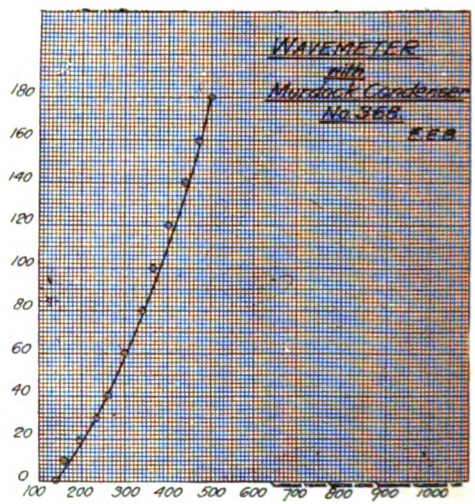


*Fig. 3*

becomes an exceedingly useful piece of apparatus for the calibration and sensitive adjustment of receiving tuners. It may also be used to calibrate coils of wire to a definite range of wave-length, thereby removing all doubt in the experimenter's mind concerning the dimensions of a coil for a given purpose. It will be noted in Fig. 7 that the condenser, C, of the wave-meter is shunted by a bell buzzer, B-1, connected in series with one or two dry cells, B-2. The windings of B-1 are shunted by a condenser of 1 microfarad capacity. If the buzzer is set into operation a change of lines of force takes place through the coil, L, which acts inductively upon the earth lead of the receiving aerial wires, A-1. Suppose,

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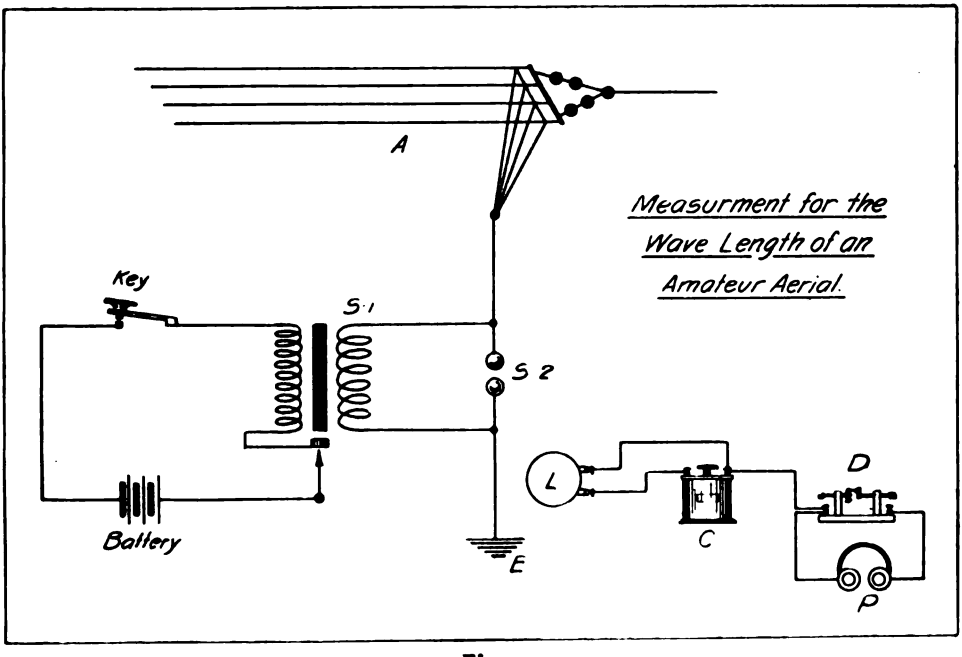


Fig. 4

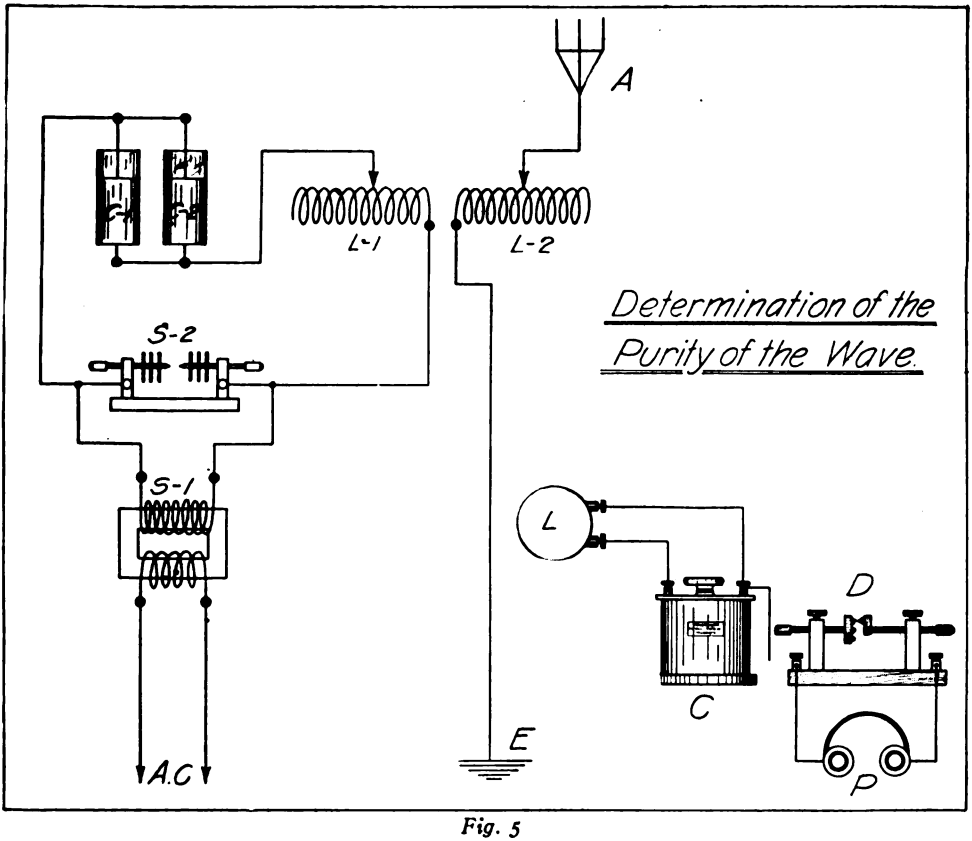


Fig. 5

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for example, it is desired to adjust the receiving system to exactly 600 meters: The condenser, C, of the wave-meter is then set at that position which will give a value of 600 meters. With the buzzer in operation, the variable contact on the coil, L-4, is altered in position until a loud response is secured in the head telephones, P. During this adjustment the secondary winding, L-5, should be placed in fairly close inductive relation to L-4 and slight variation made of its variable contact to assist in determining conditions of resonance between the two circuits. By this method the experimenter is positively assured that his receiving apparatus is adjusted to a commercial wave-length and it is therefore unnecessary to "feel about" on the variable elements until the desired station is heard. Likewise the receiving detector, D, may be adjusted to the maximum degree of sensibility by "feeling around" with the sharp point on the surafce of the crystal.

The coil, L, of the wave-meter may, if desired, be placed in close inductive relation to the coil, L-5 (the secondary winding of the receiving tuner) and the possible range of wave-length adjustment in the circuit thus obtained. During these calibrations it is important that a low value of coupling between the wave-meter and the circuit under measurement be used. The actual relative position is determined by experiment and should remain at that point where the signals are just heard.

The Mesco condenser No. 294 can be used for a wave-meter of increased range by connecting it in series with an inductance coil of increased dimensions. A hard rubber insulating tube 6½ inches in diameter and approximately 8½ inches in length was wound with 146 turns of No. 16 S. S. C. wire.

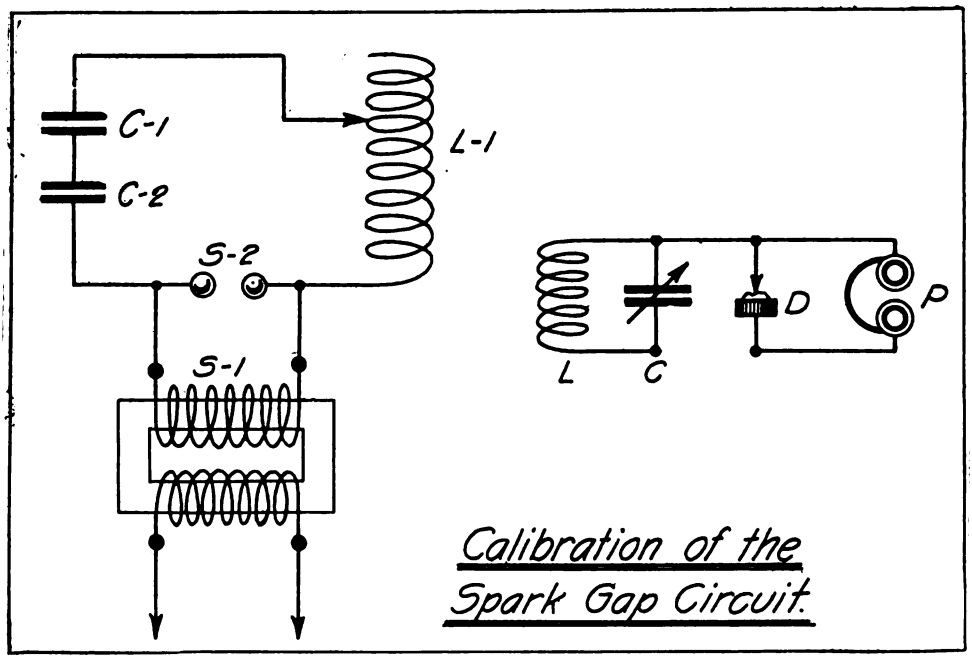


*Fig. 6*

At the tenth division of the condenser scale the wave-length of the circuit is 610 meters and at the 180th division, 2,650 meters. The intermediate values are given in the following table:

**Table No. 3**

| Degrees on the Condenser | Corresponding Wave-Lengths |
|---|---|
| 10 | 610 |
| 20 | 845 |
| 30 | 1,040 |
| 40 | 1,230 |
| 50 | 1,400 |

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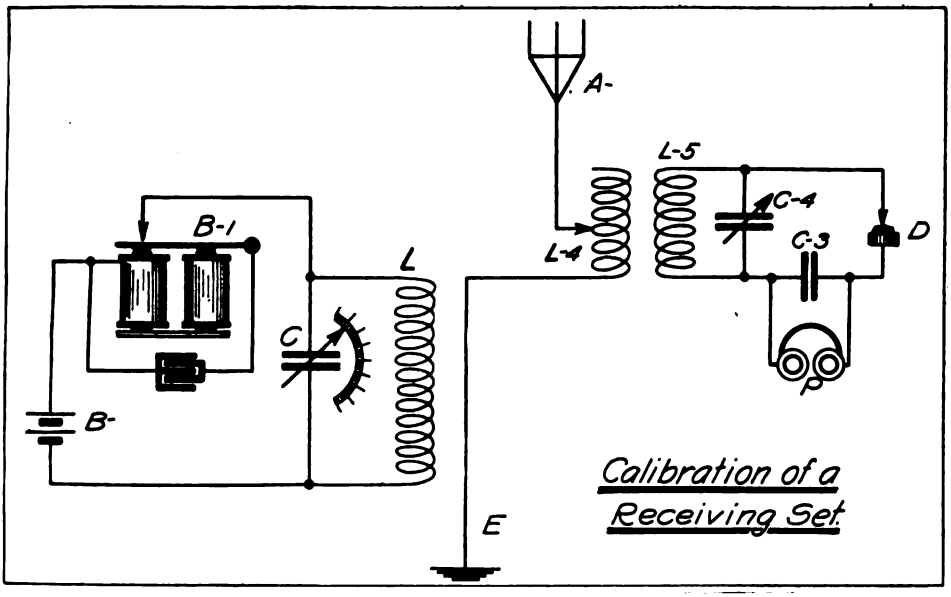


*Fig. 7*

| | |
|---|---|
| 60 | 1,570 |
| 70 | 1,660 |
| 80 | 1,780 |
| 90 | 1,875 |
| 100 | 2,000 |
| 110 | 2,100 |
| 120 | 2,170 |
| 130 | 2,285 |
| 140 | 2,350 |
| 150 | 2,410 |
| 160 | 2,495 |
| 170 | 2,565 |
| 180 | 2,650 |

The last described wave-meter fulfills the requirements of the average amateur radio station and even though, owing to the unequal construction of condensers, a slight error of calibration exists, it will be a relief to the experimenters who heretofore have not had available facilities for measuring the wave-length of their apparatus, to have an approximation of the frequency of the circuits.

Additional measurements, such as the inductance and capacitance of an amateur's aerial, are fully explained in the book, "How to Conduct a Radio Club."

*(To be continued)*

## RECOMMENDATIONS FOR THE WEATHER BUREAU

The latest report of the chief of the Weather Bureau urges the adoption of wireless as part of the equipment. Four experimental stations are now in operation. Communication with parts of the country, isolated from wire service by violent sleet or floods could be maintained by radio, and frost warnings, invaluable to fruit, truck and tobacco growers, could be scattered broadcast. Not only could vessels at sea be reached direct by wireless, but the thinly settled mountainous sections of the West could be kept under observation by means of the art. These desolate areas, uninhabited during the winter on account of their isolation and intense cold, are often the starting point of very destructive storms.

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# With the Amateurs

New Rochelle (N. Y.) amateurs met on the evening of February 3 and formed the Radio Club of New Rochelle. A committee was appointed to establish a circulating club library on wireless and electricity. Several persons well versed in wireless promised to deliver lectures.

The following officers were elected: President, John Buckman; vice-president, Etinne Donovan; secretary and treasurer, Thomas Howard. Edward Bettels was named as press agent. Correspondence is invited. It should be addressed to the secretary at 48 John street, New Rochelle, N. Y.

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The Suburban Radio Club of Washington, D. C., held its third annual election of officers on January 8. John Pursell was elected president; Charles Longfellow, Jr., secretary, and Harold Snow, chief operator. The club is the possessor of a number of valuable instruments. Persons interested in wireless telegraphy are invited to attend meetings of the organization and to correspond with the secretary at 3038 R street, Washington, D. C.

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The Society for Radio Research has been organized in Atlanta, Ga. D. Martin is president; A. Corey, vice-president and secretary, and F. Caldwell, treasurer and consulting engineer. Headquarters and the library of the society are at the home of the secretary, 379 North Jackson street. All correspondence should be addressed to Secretary Corey.

A series of lectures has been prepared, which all interested in wireless are cordially invited to attend.

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The Dot and Dash Club has been organized in East Orange, N. J., for the study of wireless telegraphy. The officers are as follows: President, Charles Summers; vice-president, Courtney Whitman; secretary, Thomas Brothers.

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The Mountain States Radio Association has been organized at Denver, Colo., for the purpose of promoting wireless communication among the amateurs of the Rocky Mountain region. Two meetings have been held. The following officers have been elected: President, D. L. Clark; vice-president, R. S. Whitaker; secretary, C. F. Neumann; treasurer, A. J. Winterer; chief operator, E. R. La Duke.

The club is made up entirely of licensed members. A time-sending service has been inaugurated, and time as received by the chief operator from Arlington is sent out nightly at 9 o'clock on a 200-meter wave-length.

Communications from other clubs are invited and should be sent to the secretary at 1523 South Ogden street, Denver, Colo.

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A club to be known as the Astoria (Ore.) Amateur Wireless Association was organized recently at the home of E. P. Hawkins, No. 556 Grand Avenue. This is the first organization of its kind ever formed in Astoria. The following officers were elected: President, E. P. Hawkins; vice-president, Carl Josephson; secretary-treasurer, Charles Gratke. H. L. Tabke has been appointed chairman of the Library Committee. The duty of this committee is to appoint a member in the second week of each month to prepare a paper on some interesting feature of wireless activity. Mr. Josephson has been appointed chairman of the Electrical Committee, the duty of which is to arrange for some new experiment to be discussed and worked out at each weekly session. Mr. Hawkins has been elected chief operator.

The organization will meet every Friday evening at the home of Mr. Hawkins, who has special quarters set aside



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for a complete wireless outfit. He owns a 1 k.w. set. The object of the association is to promote working acquaintanceship and general wireless study for amateurs. Magazines relating to the subject will be kept on file. During the summer months it is planned to establish a camp with portable wireless outfits. As soon as the project becomes feasible permanent quarters in the downtown section will be secured. The organization will eventually become affiliated with the National Amateur Wireless Association.

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A radio club has been organized in Ocean City, N. J., under the name of the Ocean City Progressive Radio Association. Ten members were present at the organization of the association and several new members have since been admitted. Anyone wishing to communicate with the club should address J. Loren Goff, secretary of the O. C. P. R. A., 411 Ninth street, Ocean City, N. J.

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The Harvard Wireless Club, active several years ago at the university, has been reorganized and taken up quarters in the basement of the Harvard Union, formerly occupied by the Harvard Crimson. The members of the club have erected aerials at the Union and Beck Hall, one of the dormitories at Harvard, and already begun sending and receiving messages.

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A class of fifty boys from the Uniontown (Pa.) high school and the eighth grade recently organized a wireless telegraphy club to be known as the Uniontown High School Radio Club. The following officers have been elected: President, Henderson Lynn; vice-president, Sam Becktel; secretary-treasurer, Robert Junk.

It was decided to hold a meeting every two weeks in the physics laboratory at the high school. There will be a special meeting, however, each week for practice. The purpose of the meetings is to instruct the members in the construction of a simple receiving wireless apparatus. Some of the members of the class already have constructed apparatus and succeeded in getting in touch with amateur stations near Pittsburgh.

At the last meeting of the Binghamton Progressive Radio Association announcement was made that the association had cleared itself of all debts. It now possesses a valuable clubhouse at Glenwood avenue and Main street. The club has been in existence for a year and has had phenomenal success. Many subjects of interest in wireless have been discussed, including that of local amateur interference. A considerable number of lectures have been given and more are planned.

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The Irvington (N. J.) Radio Club maintains a home of its own at 55 Linden avenue. It possesses a receiving set on which it has heard Colon, and it is expected that messages from points further distant will be copied when the 70-foot aerial which is now being planned is erected.

The officers of the club are as follows: President, Herman E. Enderwoods; vice-president, William G. Hunt; recording secretary, Jacob Foerster; corresponding secretary, Alfred C. Oechler; treasurer, Clarence Rossnagle; assistant treasurer, Harold Godby; librarian, Orlando Earl; chairman Good and Welfare Committee, George T. Grieshaber.

All communications should be addressed to the corresponding secretary, No. 82 Smith street, Irvington, N. J.

He has written as follows:

"All the members are interested readers of the WIRELESS AGE and the librarian has his hands full when there is a call for the book which we find so helpful to us.

"Several members are interested in the Amateur Wireless Association."

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M. B. West, of Lima, Ohio, writes as follows:

"In reference to the article by R. H. E. Matthews, published in the "From and For Those Who Help Themselves" department in the February issue of THE WIRELESS AGE.

"Such work as the author has been doing is not at all uncommon among amateurs in the Middle West, and his record is all the more notable because of the fact that signals from the vicinity of Chicago seem to fade or swing a great

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deal worse than in other localities at even greater distance. Much of this work is done on a wave-length of almost exactly 200 meters. For instance, 9KU at Winnetka, Ill., was tuned to exactly 200 meters by the radio inspector of his district and used one of the old style ¼ k.w. Packard transformers and has often equalled if not exceeded Mr. Matthews' records. I, myself, often talked with him for half an hour at a time as fast as we could send and with no repeats or long calls for adjustment. In fact most of the amateurs in and around Chicago are tuned almost exactly on 200 meters and I know of none that are doing good work whose sets are emitting two waves. 9JC, at Racine, Wis., is tuned to 200 meters, and his signals are so loud at my station that I can easily read him when in the next room, some thirty feet from the 'phones. I am using an ordinary Brandes superior 2000-ohm set.

"I have worked satisfactorily under ordinary winter night conditions with moderate Q R M, 2JD, 2KK, 2IB, 3NB, 4AA, 4CL, 9TP, 9LO, 9DM, 9BD, 9DB, 9FY, 9NN, 9SP, 9HQ and many others, and the same can be said by a considerable number of amateurs in the Middle West. Under exceptional conditions have done better than this. My set is tuned to 214 meters, which is near enough to 200 for all practical purposes, and, while not tuned exceptionally sharp, emits only one wave. When sharply tuned it covers the same distances, but takes too much jamming around with long calls to get an answer. As to daylight summer work, I have no trouble to work stations within a radius of 100 miles through any but the very worst 'static.'

"I believe it will be found upon investigation that most of these successful stations are adjusted to the exact balance required between gap speed, condenser capacity and transformer voltage, and that the majority of them are using short antenna with very low resistances. There are comparatively few such stations in the East, but the fact that there are some would indicate that the difference was in the transmitters and not in conditions or locality."

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New apparatus that will extend the sending power of the courthouse installation to more than 500 miles has been purchased by the Minneapolis Wireless Club. The new sending devices will place the station in direct communication with Chicago, Duluth, Milwaukee and other large cities. The new set will be of 1 k.w. type. The club has accepted the resignations of President William Reynolds and elevated Claude Sweeney, vice-president and station operator, to the presidency.

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Progress along all lines was reported at a recent meeting of the Washington Radio Association, in Trenton, N. J. A letter from the National Amateur Wireless Association, congratulating the Trenton Club on being one of the first organizations in New Jersey to receive a charter of membership in the national body, was read by President Pillsbury. Plans are being made for the installation of a high-power transmitter at the headquarters of the association in the Washington Market Building. All amateurs in Trenton are invited to attend the weekly meetings, which are held each Thursday evening.

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The death of Virgil Simpson, who had been active in amateur wireless in St. Louis, occurred on February 4. He was one of several students who installed the wireless station at Christian Brothers' College and he was actively in charge of the station until his graduation in June, 1914. Since then he had continued to take an interest in it and spent much of his spare time in the college laboratory. He was 21 years old.

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The data given for the dimensions of the coil, L-4, in the article "How to Conduct a Radio Club," in the January, 1916, issue of THE WIRELESS AGE, page 244, read incorrectly. It should have read as follows: The coil, L-3, the secondary winding for the coil, L-4, may be 5 inches in length by 4½ inches in diameter, etc.

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William H. Kerwan, of 9XE, who initiated the New Year's call described in last month's WIRELESS AGE, ushered in Washington's Birthday with a general call for preparedness. It was picked up officially by at least 5,000 amateurs.

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# Wireless Equipped Aeroplanes in Warfare

**Radio Flying Machines an Important Feature in Plans for Our Coast Defense**

*The successful wireless experiments by aeroplane carried out at Hendon. Mr. Valentine's Bristol monoplane is being fitted with the installation, only 40 feet of wire being necessary to complete the station on the aeroplane. The experiments proved successful*

"IT'S the scout of the air. It's faster than the fastest ship, with a voice that can talk to the gunner waiting on land or sea, half a hundred miles away."

The man who spoke these words had just spent six months abroad. And for the first time in that period his words were "uncensored."

"If you'd heard the explosions—bombs from a German airship, dropping down on the heart of London—you'd say with me, we need such scouts by the thousand. And that's the way they guard Paris, day and night. The scouts are always up, armed with cannon—inch-and-a-half Hotchkiss guns, ready to fight or to warn the men at the anti-aircraft guns below."

The speaker is one of the greatest authorities on aeronautics in the country. The air scout of which he spoke was the wireless equipped aeroplane. He had seen it in operation. That was the reason for the emphasis he laid on his words. One could divine that events such as he had witnessed had left an indelible impression on his mind.

The conclusions he had derived from practical observations, are, moreover, the opinions of the best minds in the country that have devoted themselves to a study of this subject. Many of these men have formulated plans for our coast defense, one of the chief features of which is the aero-radio signal corps. It is the voice of the wireless equipped aeroplane that must warn our country of a coming foe. It is the deadly enemy of the submarine, as the submarine is fearsome to the dreadnought.

"The United States should have 2,000 aeroplanes," says Henry Woodhouse, governor of the Aero Club of America,



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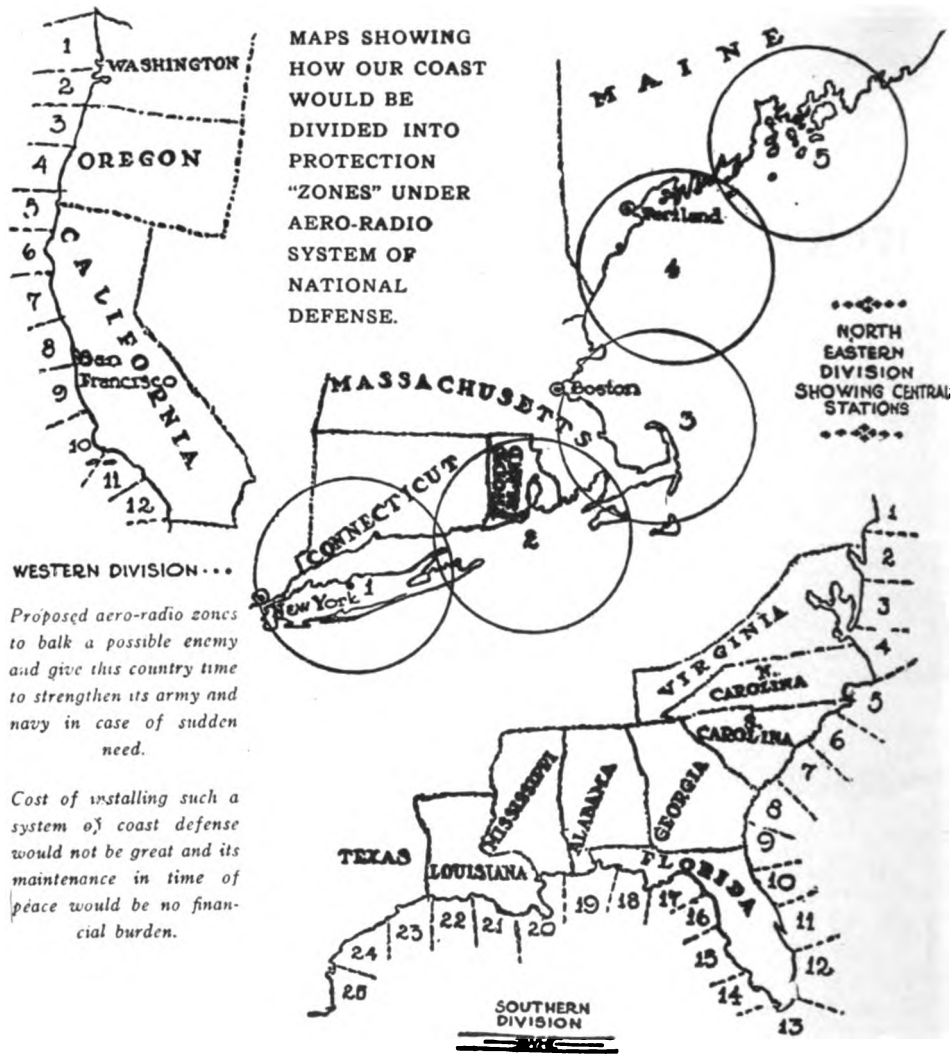
MAPS SHOWING HOW OUR COAST WOULD BE DIVIDED INTO PROTECTION "ZONES" UNDER AERO-RADIO SYSTEM OF NATIONAL DEFENSE.
WASHINGTON
OREGON
CALIFORNIA
San Francisco
WESTERN DIVISION
Proposed aero-radio zones to balk a possible enemy and give this country time to strengthen its army and navy in case of sudden need.
Cost of installing such a system of coast defense would not be great and its maintenance in time of peace would be no financial burden.
MAINE
Portland
Boston
MASSACHUSETTS
CONNECTICUT
New York
NORTH EASTERN DIVISION SHOWING CENTRAL STATIONS
VIRGINIA
N. CAROLINA
S. CAROLINA
GEORGIA
FLORIDA
ALABAMA
MISSISSIPPI
LOUISIANA
TEXAS
SOUTHERN DIVISION

*Courtesy of Flying*

*This aero-wireless system of coast defense has been endorsed by President Wilson, the Secretary of War and the Secretary of the Navy. This plan provides for the patrolling of all our coasts by forty-four aeroplanes, and these, with the wireless installation, receiving stations, hangars and other equipment, would cost less than* $500,000. *There would be three shifts of aviators, or* 132 *men, and these, with forty telegraphers, would be able to man the whole system. Maine would have three stations or zones; Massachusetts, Rhode Island and New Jersey, one zone; Virginia and North Carolina, two zones; South Carolina, three zones; Georgia, one zone; Florida, nine zones; Alabama, one zone; Mississippi, one zone; Louisiana, three zones; Texas, three zones; California, eight zones, and Oregon and Washington, two zones each*

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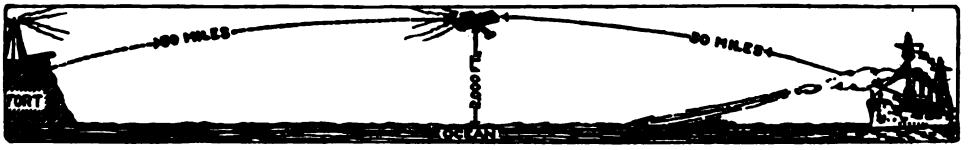



*An aeroplane can fly fifty miles out at sea and from a height of 2,000 feet glimpse a ship fifty miles away*

"and it has but twenty. This is our deplorable situation in a nutshell."

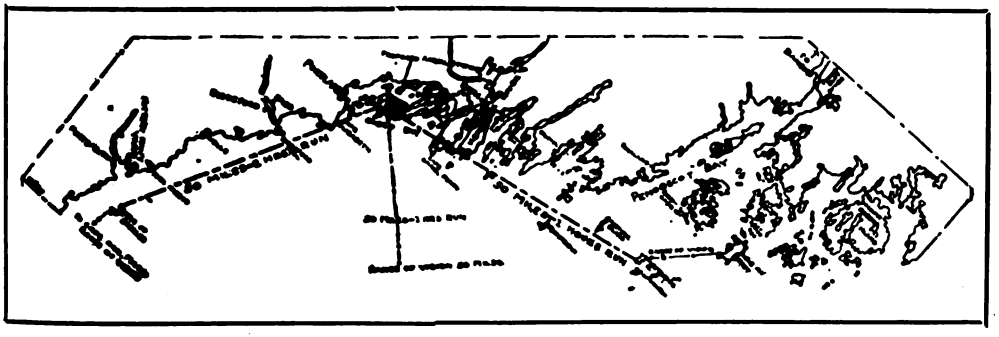
Henry A. Wise Wood expresses the belief that the time has come in the development of aeronautics when aerial fleets must be reckoned with as vital arms in a country's means of defense. Of the aeroplane afloat, he says: "It is an incomparable scout, with three times the speed of a ship of the line; it may go far afield in its work and regain its vessel at will; and with a trained observer and wireless outfit, it can communicate its discoveries while within fifty miles of its base."

John Hays Hammond, Jr., has formulated an excellent system of protective surveillance to guard our coast fortifications, the country's second line of defense. He submitted the details to the Aero Club of America. His defensive plan embraces the construction of inexpensive radio receiving stations along shore, one hundred miles apart, provided with aeroplanes equipped with wireless, which, he believes, will make it possible to protect the Atlantic and Pacific coasts and the Mexican border. The proposal has been laid before the heads of the National Guard and the Naval Militia and of the States, which are co-operating with the Club in developing aviation corps in the National Guard and Naval Militia. In presenting a drawing of the northeastern division of our coast line, Mr. Hammond says:

"I have shown five areas of fifty-mile radius, constituting the patrol areas for five aero scouts. In the centre (approximately) of each area is situated a radio receiving station connected with land lines. Each aero scout is equipped with a radio transmitter of sixty-mile daylight radius. Each scout is in constant communication with his central radio station, and each station is directly connected by phone or telegraph with the existing land system.

"The movement of ships, their disposition and the strategy of the enemy will be readily discovered with the information obtained from scouts covering such an extended front. An intelligent understanding of the enemy's purpose would be gained and our forces could be concentrated at decisive points to meet the invader.

"From New York to Mount Desert,



***Map showing the location** of the proposed first unit of the aero-wireless system, to be **established at Portland**, Maine. Admiral Peary has given the use of Upper Flag Island there as a base for the headquarters of Zone No. 1*

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five areas would be located. From New York to the Mexican border, seventeen would be established, and on the Pacific coast there would be eleven more."

Mr. Hammond's proposed coast patrol is regarded as an invaluable aid to our established coast defenses, as well as to our mobile forces, for the aeroplane has proved itself an efficient aid in gunfire, especially where the range has got beyond the reach of the masthead spotters, as well as where indirect fire is necessary.

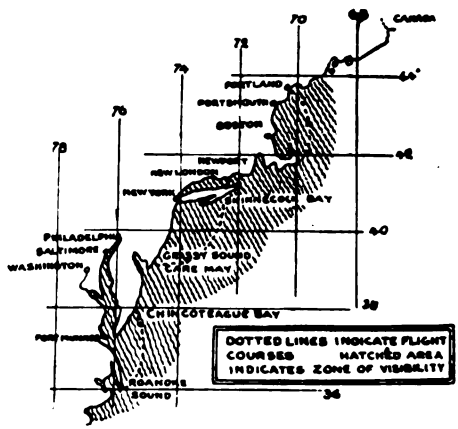
### Hydroaeroplane Zones

Another plan for the defense of our seacoast by the use of hydroaeroplanes has been formulated by an air strategist, Captain Virginius E. Clark, of the Aviation Corps, U. S. A. This scheme was first made public in an issue of the Coast Artillery Journal, published by the officers of the Coast Artillery Corps. Captain Clark, an Annapolis man, was graduated from the Naval Academy in 1907, and after two years of service afloat, was transferred at his own request to the coast artillery arm of the army. He prepared a strategic map of the Atlantic coast line from a point below Roanoke Sound, N. C., to another just north of Portland, Me. In this way he divided the coast into three hydroaeroplane zones, the centre of the northern zone being Boston; of the central zone, New York, and of the southern zone, Fort Monroe, Va.

"In discussing," says Captain Clark, "the adaptation of the hydroaeroplane to coast reconnaissance, I will assume that the machine will always carry two men, who will divide between them the duties of pilot, observer and signalman, and be provided with compass, other instruments, and a signal transmitting equipment. For some purposes the latter should be a wireless outfit; and for others, a smoke-puff device, such as a cylinder containing soot with apertures which can be opened and closed by the signalman."

This description of the air strategist lends emphasis to the fact that extraordinary advances in aeroplane construction have been made every few months since the great war began in Europe. The original German Taube, a marvel at the commencement of the war, has long since been superseded by other craft, the latest model being the Fokker monoplane. French machines, originally armed with small machine guns, are now mounted with guns of larger calibre. As I write this, Great Britain is said to have placed an order in this country for ten torpedo-carrying triplane hydroaeroplanes, each carrying six men, and a 3½-inch rapid-fire gun in addition to machine guns. And smoke-bombs and smoke-puff devices are being rapidly superseded by wireless directions for the location of targets.

"Practical tests in France," continues Captain Clark, "have shown that a compact wireless outfit, weighing only about




*The aero-wireless coast defense plan formulated by Captain Virginius E. Clark, of the Aviation Corps, U. S. A.*

sixty pounds with antenna, and not interfering with the flight of the areoplane, is capable of sending messages sixty miles, under ordinary conditions.

"In the map have been indicated roughly three flight courses, illustrating a plan by which, in case of an expected approach by hostile men-of-war or transports, three hydroaeroplanes may effect a more complete reconnaissance of our North Atlantic coast waters by making, back and forth, daily flights of three hours' duration, than would be possible by employing a score of the fastest destroyers.

"On a day of average atmospheric transparency, an observer in a machine flying at a height of 2,000 feet could make out a fleet of vessels at a distance

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of at least fifty nautical miles. After he had entered the area in which the enemy would be visible to at least one of the flying scouts, the size of the fleet, the character of his vessels, and the direction of his movement would be reported to the waiting coast defense commanders. The report would at the very least, give the Coast Artillery personnel at New York, Fort Monroe, Boston and Philadelphia, fifteen hours, and at the other fortified points within the zone, eight hours in which to prepare powder, fire trial shells, and even, possibly, provide more troops for the points not threatened and those that appeared to be in danger. In the meantime the enemy would be utterly unaware of the presence of the air scout. It is impossible to see or hear an aeroplane at a distance of even ten miles.

"A hydroaeroplane equipped with wireless, circling over a line normal to the line of fire drawn from the target, as close to the target as safety permitted, could, by using a simple code, keep the fire commanders on shore constantly informed as to the proper range corrections."

Indeed, as Mr. Marconi recently pointed out, aeroplanes with a small wireless outfit can remain in the enemy's zone, and continue their scouting operations while still in touch with their own army and communicating with their headquarters.

Here we see then the lines of thought and effort to which men of public spirit and enterprise, with military and scientific knowledge, are devoting their attention today, in the conviction that aircraft equipped with wireless are a prime essential in the plans for the protection of the first and second lines of our country's defense. While these are studying the strategical and tactical values of the wireless-equipped aeroplane and hydroaeroplane, the best inventive minds of the United States and in fact of the world, are seeking the development of the wireless equipment best adapted to aircraft and elaboration of methods for the control and operation of torpedoes and other forms of explosives by wireless.

Rear Admiral Bradley Allen Fiske, of the Navy War College, has already succeeded in converting the seaplane into an aerial torpedo craft, so arranging it that a torpedo may be launched from it with ease and precision. Admiral Fiske has already taken out fifty-seven patents and has three more pending. He invented, in 1890, what has come to be known as the Sir Percy Scott method of pointing guns on shipboard, and in 1904 he conceived the turret range finder. His recently patented invention is, in effect, an aerial torpedo boat—a hydroaeroplane from which a torpedo may be discharged into the water.

In recently describing his invention, Admiral Fiske said he wished to correct a misapprehension regarding the possibilities of the aerial torpedo boat, in that it could be used in attacking a fleet in a land-locked harbor. "This would," he said, "be difficult to achieve without the destruction of the aeroplane, which probably would be destroyed before reaching the fleet. What I had in mind was rather an attack on a fleet in the open sea, or one which had taken refuge in a large inland body of water of considerable size, where the aeroplanes could rise over some intervening hills and would have plenty of room and some opportunity to discharge their torpedoes before the gunners of the fleet could attack them."

Admiral Fiske said he first became interested in the subject of steering torpedoes by wireless in July, 1897, while stationed at Chemulpo, Korea, and reading of the work that had been accomplished by various scientists in sending an electric signal across space. Edison and Sims, he said, had already worked on the plan of steering a torpedo by wire, and it occurred to him that this could be simplified by doing it without wires. He invented at that time a device for the wireless steering of torpedoes, and since then, he said, John Hays Hammond, Jr., has done excellent work along similar lines.

"A torpedo," said Admiral Fiske, "is steered by wireless through the means of two solenoids which are affected by impulses transmitted by Hertzian waves of varying periodicity. Thus the touching of one key at the sending station will turn it to the right and another to the left. Mr. Hammond, I understand, can control torpedoes by wireless as far dis-

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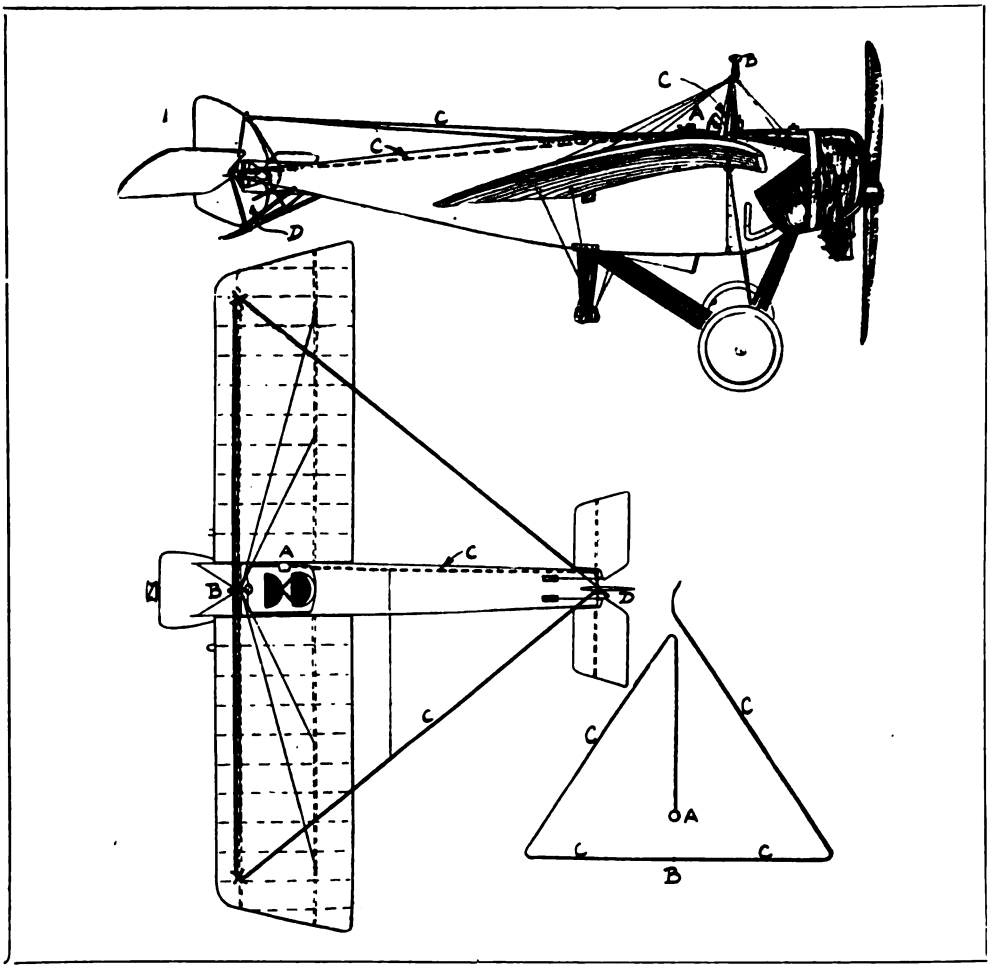


*Method of installing aerial on monoplanes used by French and Belgians in war*

tant as twenty-eight miles if need be; he can make any ordinary torpedo into a dirigible by the use of certain slight modifications. I understand that as a matter of experiment, he has found that he can even control torpedoes by his voice, pitching it on different notes to affect the steering apparatus in various ways.

"Now the uses of such a torpedo are obvious. You do not have to aim a torpedo and trust to luck that the ship you are firing at will be in the line on which the torpedo is going when the torpedo gets there. You can even fire a torpedo from the opposite side of your ship to that on which the enemy is situated, directing the torpedo clear around your own ship and then sending it at the enemy. As he turns you can turn your torpedo. Aside from a ship, it could be furthermore operated from shore or from an aeroplane. In coast defense, especially of some such body of water as Chesapeake Bay, it would be invaluable, for from small hidden stations on the shore, torpedoes could be discharged as well as from destroyers or submarines.

"It may be said that under such conditions the chances of hitting the hostile ship might be slight. That difficulty will be obviated by the use of 'spotting' aeroplanes, such as are now used in artillery firing. An airman, high above the enemy's position, signals back to the battery far away in his rear what changes in elevation should be made in order to drop the shells with better effect. So a 'spotting' aeroplane could signal back to the

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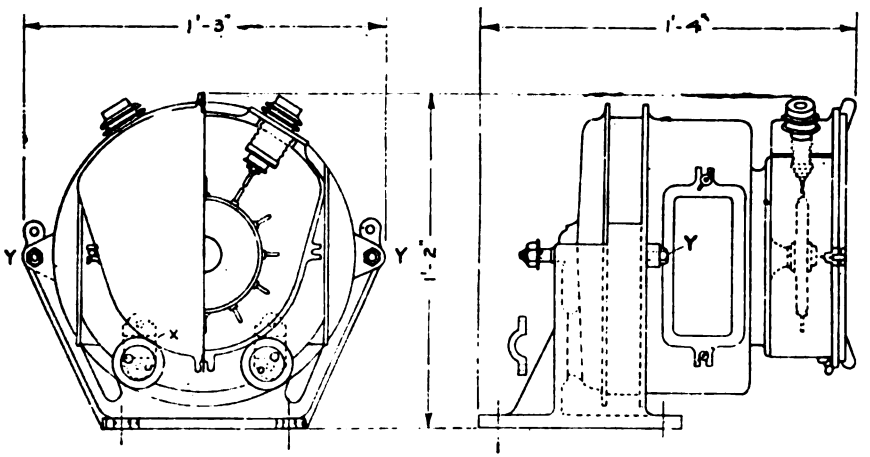


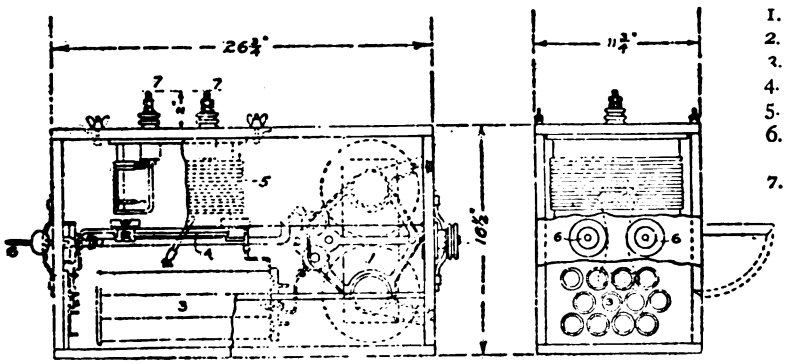

*Fig. 1*

shore station from which the torpedo is directed; or when a torpedo is once launched from shore, it could be steered by an apparatus in the aeroplane.

"The hydroplane torpedo boat, after rising to a great height, could direct its own torpedo in this way."

Admiral Fiske expresses the belief that torpedoes have been launched from aeroplanes in the present war. "It is the natural tendency of the American people," he added, "to expect their inventors in time of war to think up devices which will offset the initial superiority of their enemies."

This naval expert apparently refers to the mysterious explosions that have occurred on and destroyed the warships Bulwark, Princess Irene, Natal and the Benedetto Brin. These "war mysteries" have stimulated the imaginations of scores of war correspondents, and long series of real or imaginary inventions and devices have been described in glowing and unscientific terms ever since the commencement of the war. Thus a dispatch from Rotterdam some months ago described an aerial torpedo which it was purposed to use in the new super-Zeppelins. It was described as being made of aluminum, and filled with gas when discharged from a tube in the airship. These




1. *Transformer*
2. *Choke coils*
3. *Condensers*
4. *Jigger primary*
5. *Jigger secondary*
6. *Connections to Disc Discharger*
7. *Aerial and earth terminal*

*Fig. 2*

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torpedoes, it was said, are sustained by gas and controlled by wireless from the airship. They can be directed from a great distance and exploded at any point required. It was said that this device was an elaboration of an invention by a Swedish officer. Time alone must show whether these subjects so treated are mere "war romances" or actual devices.

**Marconi Aeroplane Set**

There can be no dispute, however, of the fact that the aerial scout, equipped with wireless, has emerged from the pages of romance to assume a definite place in modern fighting equipment. And there has been a wide application of wireless to military aircraft, and a continuation of marked development. The type L Marconi aeroplane set, for example, has been so developed that it may be adapted to any type of machine. A consideration of the utmost importance has been the effecting of a wide margin for the distribution of weight, so the set has been made up into several separately contained units, which may be fitted underneath the pilot's seat and in any position; even placed upside down if necessary.

Figure 1 gives the front and side views of the disc discharger attached to the shaft of the motor generator. The generator is run by a belt drive from the motor of the aeroplane and absorbs less than two-thirds of one horsepower. The dynamo can be supported by a horizontal tube at X, one and one-eighth inches in diameter, and with the lugs at Y, in which case the supporting pedestal shown is not required. The total weight of the generator and disc discharger is 80 pounds

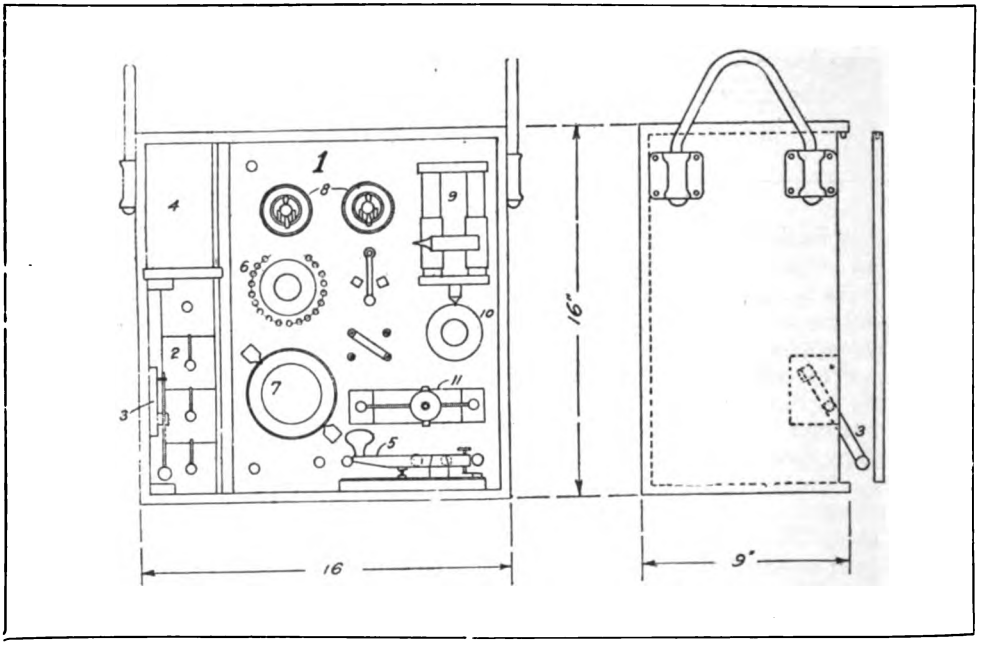


*Fig. 3.*—(1) *Receiver,* (2) *Batteries,* (3) *Battery cutout,* (4) *Telephones,* (5) *Manipulating key,* (6) *Aerial tuning inductance,* (7) *Aerial tuning condenser,* (8) *Crystal holders,* (9) *Valve tuning condenser,* (10) *Intensifier,* (11) *Potentiometer*

Primary or secondary batteries can also be used, and if the latter type are adopted, a special unspillable accumulator case is supplied, preventing acid from splashing out and damaging the machine in the event of a rough landing or a fall.

The transmitting unit, shown in detail in Figure 2, is contained in a polished hardwood case and weighs 84 pounds.

The portable receiver, shown in Figure 3, is built exceptionally light, weighing less than 20 pounds.

A general view of the equipment fitted to a monoplane now in use by the French

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and Belgian armies is shown in an accompanying drawing. Using the upper pylon, B, as a mast, the aerial wire is run once around the plane from tail to wing tips and back, the remainder of the wire trailing from the extreme end of the tail skid. A counterpoise capacity is used in

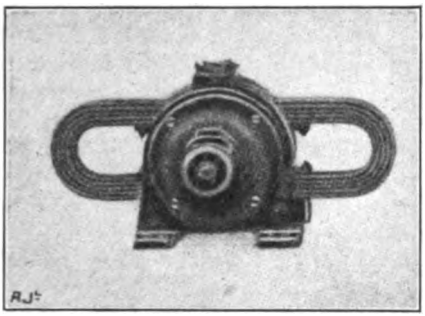

*Fig. 4.—Bethenod Magneto-Alternator*

place of a ground connection, or in place of other trailing wire used when the outfit is fitted on a biplane. The plan to the left of the drawing shows a general view of the antenna seen from the above plane.

The three united units are placed in the cockpit of the monoplane in front of the pilot's or observer's seat, with the receiving unit and manipulating key so placed to the right of either of them that adjustments can be made on the tuning coils or the key be operated by either one. All parts are highly insulated and there is no danger of either person receiving an electric shock.

The aerial trailing wire attached to the tail skid is fitted with a safety catch adjusted to stand only as much strain as it would be subjected to when the machine is flying; in the event of its becoming entangled in trees, housetops or any other obstruction, it frees itself immediately. Aerial trailers lost in this fashion are replaced by spare wires provided for the purpose. As the wave-length is comparatively short, the receiving apparatus is seldom troubled by interference and little adjustment is required in tuning.

This efficient aeroplane equipment has recently been applied with success to submarines, an insulated jet of water being used as an aerial conductor.

There were two sizes of wireless sets for use on aeroplanes in the French army and navy at the beginning of the war. According to a description in the Aerial Age, the smaller of the two had a range of about 62 miles and weighed complete about 77 pounds. The larger set, weighing about 105 pounds, had a range of 124 miles.

The aerial consists of a bronze cable about three sixty-fourths of an inch in diameter, having at its loose end a spindle of sufficient weight to cause it to unroll from the drum and to give the tension required. The aerial is cast loose after the aeroplane has taken flight, and owing to the weight of its free end. and the speed of the machine, it trails in a nearly horizontal position, offering so little resistance to the air that this feature is negligible.

Ordinarily this cable is wound on a spool with insulated sides and handle, and the spool is fitted with a circular device so arranged that the cable may be wound or unwound without interrupting the operation of the apparatus. It also permits the rapid turning of the different circuits. A cutter with insulated handle enables the operator instantly to sever the cable in case any situation should arise where-

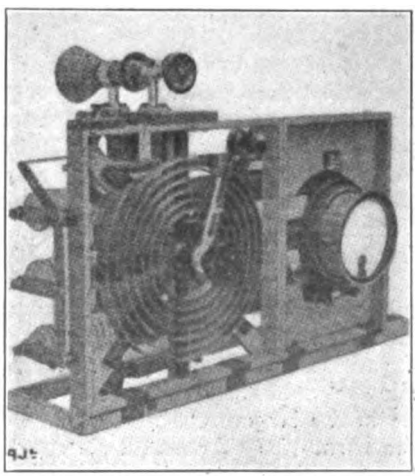

*Fig. 5.—Oscillating Circuit*

in the trailing wire would be a menace to the safety of the machine.

The "earth" connection is effected by an electrical capacity consisting of all the

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metallic parts of the machine being connected together electrically. The metallic parts, which are insulated from each other, or in which the contact is poor, are carefully joined by means of very small electric connections.

The aerial is indirectly excited by means of a musical note transmitter consisting of a generator, transformer, oscillating circuit and manipulating key.

The generator consists of a special Bethenod magneto-alternator having an output of 350 watts, low tension, and giving 800 sparks per second. This alternator (Fig. 4), does not have any current collecting rings or commutator, and as a result it is extremely strong and simple. The generator is driven from the aeroplane motor either by a friction drive or by gearing.

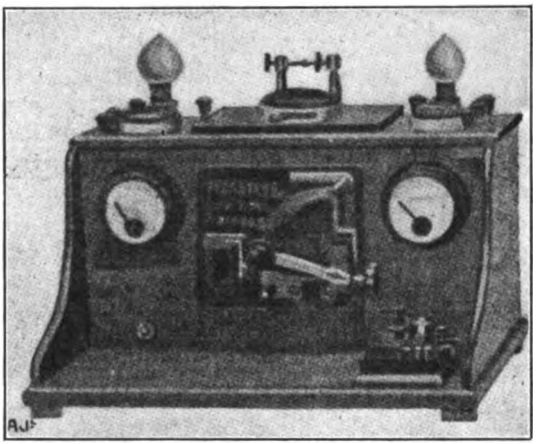

*Fig. 8.—Wireless set for use with accumulators*

For the larger set a special Bethenod resonance alternator, as illustrated in Fig. 7, is provided, and it is driven from the motor in the same way that the smaller set is driven. This generator has a normal output of 750 watts, 1,500 cycles, at a speed of 4,500 revolutions per minute. Generally speaking, this generator is of the same type as those used in land stations and portable military stations.

The oscillating circuits (Fig. 5) of both sets are arranged so as to give a wave-length of 400 meters, and consist of a condenser, having a capacity of .001 microfarad, and a spark gap, which in the smaller set is of the point and plate type; while in the larger set the electrodes are in the form of a tube and a plate, which is fitted with a special ventilating arrangement A high frequency ammeter is also connected in the circuit.

The aerial for the larger set is similar in general design to that used with the smaller station, as is also the variometer, which allows the wave-length to be instantly varied in a continuous manner without interrupting the operation of the transmitter; and transmitting is effected on the low tension primary circuit, by means of a light sending key, in both sets.

With certain modifications these two types, which have been designed primarily for use on aeroplanes, may be used on seaplanes. As the seaplane station must be capable of being operated while the plane is on the water, an independent source of supply of energy is the first requisite to maintain communication while the motor is shut down and a new scheme is also necessary for the aerial.

To furnish power when the seaplane motor is still, a light water-cooled single-cylinder motor, developing 1 B.H.P., and weighing 20 pounds, is provided with the 62-mile set, while the motor for the 124-mile set weighs 39 pounds, has two cylinders, and develops 3 B.H.P. In both sets the motor drives the alternator by means of a belt.

The receiving sets weigh about two pounds and are fitted with both crystal and electrolytic detectors and very sensitive loud-speaking double headgear telephones to enable the operator to receive signals when the motor is running. The 'phones are also combined with the aviators' helmets in order to facilitate reception.

When the machine is in the air, the aerial cable is unrolled beneath the craft, but when the plane is on the surface of the water, the end of the cable is attached to a special type of box kite, of very small dimensions when closed, and when opened has a surface area of 80 square feet, which is sufficient to keep it up even in a very light breeze. The kite opens quickly, and there is nothing for the operator to do but to fasten the end of the aerial to it and allow it to unwind as he descends. This box kite arrangement gives a much

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longer range than is possible while the seaplane is in flight.

Where it is undesirable to install an auxiliary motor, it is possible to have an equipment consisting of a musical vibrator (Fig. 8), with its condenser, an induction coil, spark gap with point and plate electrodes, sending key, etc. The energy in this case is furnished by a battery of accumulators of light weight, which supply current for the set for a period of ten hours continuously, and the total weight of the set would be 70 pounds. The output of this apparatus is 50 watts, and it is possible to transmit about 50 miles during the daytime.

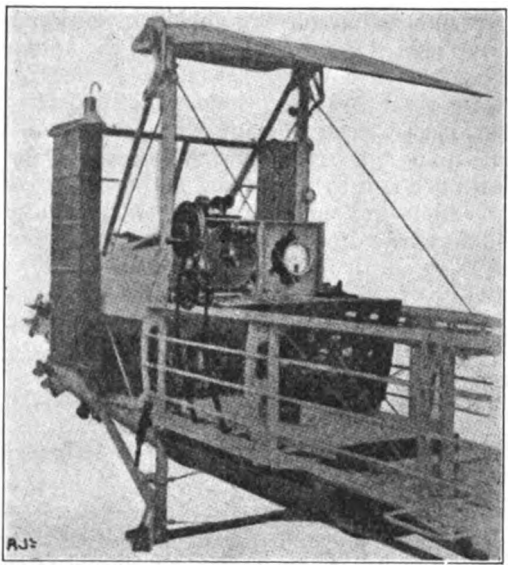

*Fig. 9.—Wireless set mounted on aeroplane*

### Other Ingenious Minds

It may prove a stimulus to other ingenious minds to learn what problems are being considered or have been solved by inventors in connection with wireless equipped aeroplanes. An American recently obtained a patent, the primary objects of which are the accomplishment of efficient communication between moving bodies, such as balloons and flying machines and other stations situated either on the earth or on other moving vehicles. The invention in the illustration (Fig. 10), is applied to a flying machine proper to enable it to communicate with the shore or ships or other flying machines. The drawing represents the apparatus in diagram.

The inventor says that he overcomes difficulties and gains other advantages by substituting for antenna, two extended surfaces of conducting material arranged horizontally so as to form the two capacities of a horizontal antenna. By making these capacities of sheets of aluminum foil, for example, they may be applied to the structure of a vessel, as on balloons or aeroplanes.

An additional advantage, he says, is gained by the ability to place the capacity surfaces in a horizontal or in any other desired plane, and thus give directive effect to the messages, so that a scout could communicate with his own camp without sending signals in the enemy's direction. As arranged, for example in

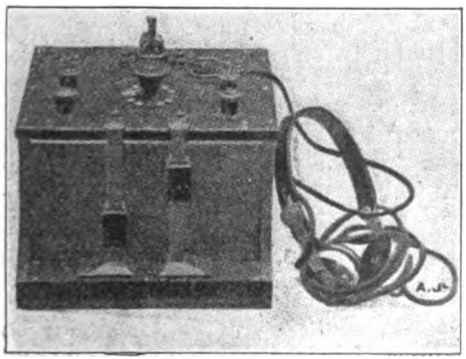

*Fig. 6.—Receiver*

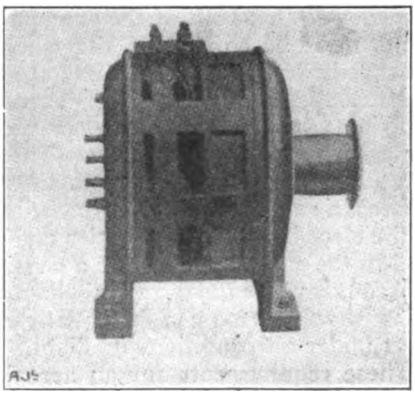

*Fig. 7.—Bethenod Resonance-Alternator*

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the drawing, which represents such a machine as the Wright aeroplane, the main supporting planes are of stretched canvas; on these, placed to the right and left of the machine, are provided surfaces of metal such as tin or aluminum foil. From these surfaces conductors are run to the signaling instruments, which are here shown for simplicity as a spark gap and a receiver.

An entirely different view of the application of wireless to aeroplanes is taken by a German inventor, who has taken out a patent on an antenna structure designed so as not to interfere with the ordinary construction or operation of the aeroplane (Fig. 11). The inventor maintains that the difficulty arises in application of wireless to flying machines; that land or sea is not close enough when the machine is in flight to serve as one of the elements, so that both of the antenna elements must be carried on the machine. He says he has found that there are several essential requirements to be met in applying wireless transmitting or receiving equipments to aeroplanes. The antenna structure should be arranged so as to effect a substantially uniform radiation of the electric waves on all sides and parallel to the earth and to have a considerable range, while the electrical characteristics should remain substantially constant under all conditions of flight.

These requirements for an aeroplane, he asserts, are nicely met in accordance with his invention by consolidating one element of the antenna structure with the aeroplane structure, either by utilizing the conducting parts thereof or by mounting wires on the structure; and in forming the second by the use of an insulating mast and conductors. He discovered by experiment that a mast of more than six meters or thereabouts may render the aeroplane unstable or unsafe, but that a mast of the kind herein shown of a height within this limit is sufficient to give the desired range of transmission to the wireless equipment.

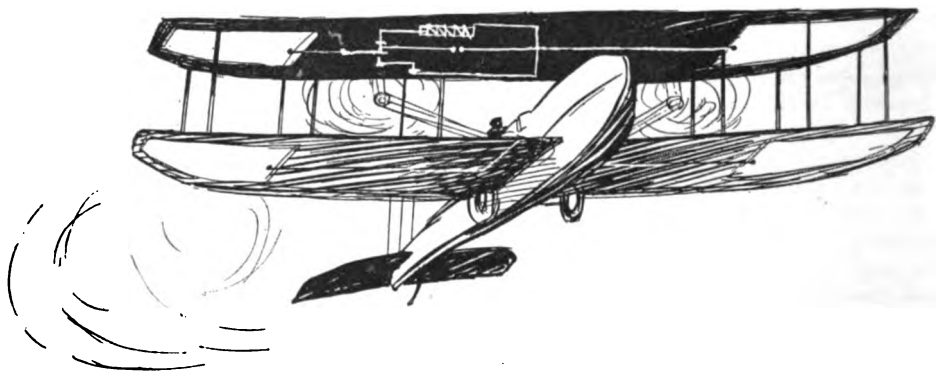

*Fig. 10.—Wireless-equipped aeroplane without antenna. The inventor has substituted two extended surfaces of conducting material, so as to form the two capacities of a horizontal antenna. From these surfaces, made of aluminum foil, conductors are run to the signaling instruments*

In the drawing he shows in perspective view a biplane of ordinary form, having the supporting planes, 1 and 2, the landing gear, 3, and the frame, 4. The steel tube, 5, is rigidly mounted on the frame With the gable arrangement of the wires, 8, it is permissible to extend the steel tube above the upper supporting plane. The bamboo mast, 7, extends in a substantially vertical direction from the tube, 5. The wireless transmitting and receiving mechanism of suitable type is mounted in the aeroplane and is connected on one side with the areoplane structure and on the other side with the elevated element of the antenna structure by means of the conductor, 10.

A third difference in application is shown in a patent obtained by a French inventor, who reasons that in fitting up a wireless telegraph station upon an aeroplane, it is of great importance that in

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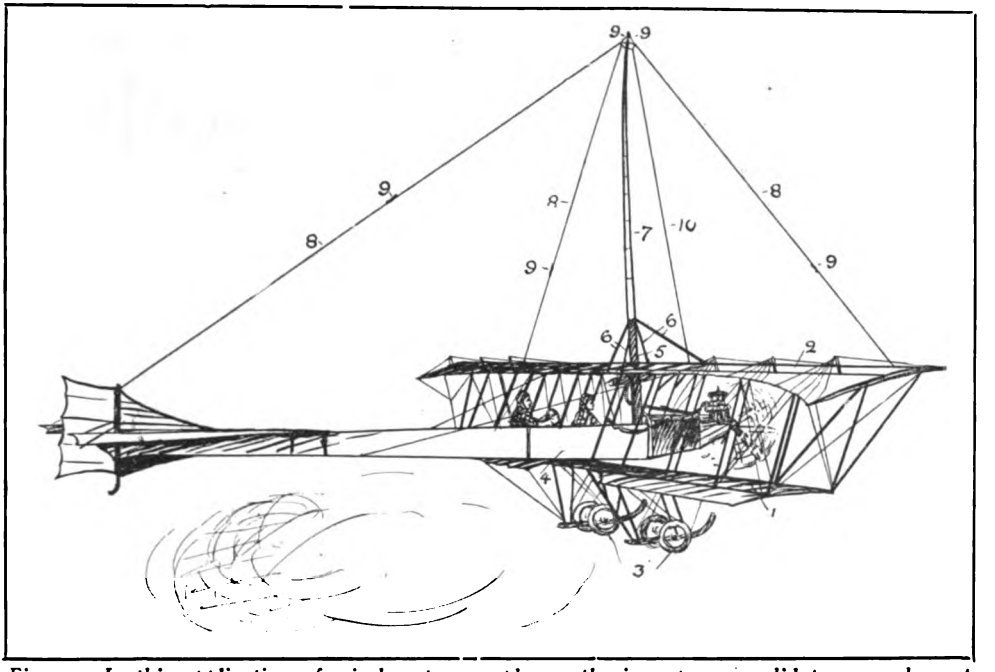


*Fig. 11.—In this application of wireless to aeroplanes, the inventor consolidates one element of the antenna structure with the aeroplane structure, and forms the second by the use of an insulating mast and conductors*

operation there shall be absolute protection from the possibility of the aviator's receiving a fatal or other electric shock. (Fig. 12). The pilot, in particular, must not be exposed to the fear of accident through coming in contact with the installation. In fitting up a station on the aeroplane with floating antenna, that is, a wire hanging beneath the areoplane, he asserts that all the fixed parts of the installation can be perfectly insulated. The winch, however, for rolling up and unrolling the antenna presents greater difficulty in the matter of perfect insulation, he adds, and emphasizes the fact that the winch is the part of the apparatus which has to be most often manipulated.

His invention relates to a general arrangement of the installation, by which a tension node is obtained at the starting point of the antenna, that is to say at the winch upon which it is rolled. In this way the insulating of this portion becomes very simple and the dangers of sparks or electrification through contact with this part are practically eliminated.

The drawing (Fig. 12) shows an example of this arrangement and a diagram of the same arrangement. It shows an aeroplane which is provided with a wireless installation constructed according to the invention.

Such are some of the problems confronting the men who are studying the potential value of the wireless equipped aeroplane, its construction, its strategy. "We need such scouts by the thousands!" To the scientist, the inventor, the patriot, here is a study worth a life's endeavor.

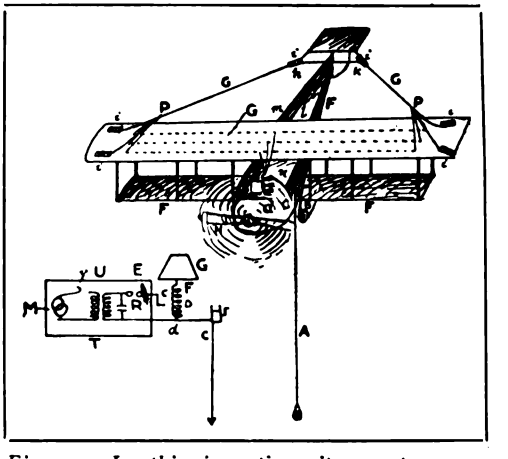


*Fig. 12.—In this invention, its creator uses floating antenna, but insulates the installation to prevent the aviator or pilot from receiving an electric shock*

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# From and For those who help themselves

## Experimenters' Experiences.

*The editor of this department will give preferential attention to contributions containing full constructional details, in addition to drawings.*

### FIRST PRIZE, TEN DOLLARS

### A Novel Dead-End Switch for Receiving Transformers

In looking over the designs of dead-end eliminating switches described by amateurs, I find that the majority are constructed so that insulating material passes directly over the electrical contacts with the consequent danger of fouling. The switch which I present in the accompanying drawings entirely eliminates the difficulty by the device shown in detail in the lower righthand corner of Fig. 2.

The manner in which this switch operates will be clear from an examination of the diagram of connections (Fig. 4), wherein it will be observed that the various sections of the tuner winding are designated at points 1, 2, 3, 4, 5, 6, 7 and 8. These sections are disconnected from each other by means of a spring contact resting directly over the points of the multiple-point switch upon which the handle of the lever operates. As indicated in Fig. 4, sections 1 to 5 are in use, but 6, 7 and 8 are disconnected from the circuit at point a—that is to say, section 5 is metallically disconnected from section 6 by the lever of the switch, to which is attached a piece of hard rubber which separates the points, a and b, as shown in the detail of Fig. 2.

It is to be noted that the contacts in the switch blade are mounted inside of the secondary tube which tends to protect them from dirt and oxidization. As shown in Fig. 3, a hard rubber knob and an adjustment scale are mounted on the outside of the tube. This scale should be divided to correspond with the number of contacts inside. The knob should carry a pointer attached in respect to the switch blade, so that the contact upon which it rests is clearly indicated.

The switch blade may be cut from 1/16-inch spring brass; the dimensions will depend upon the diameter of the secondary tube. As shown in detail in the lower left-hand corner of Fig. 2, a groove should be filed in the switch blade to effect an edgewise contact. Small holes are drilled at the points indicated in the drawing to receive small copper rivets made from No. 14 wire. A piece of 1/16-inch hard rubber should be cut as shown in the same detail, and fastened to the switch blade by means of the rivets. As mentioned previously, this piece of rubber serves to break the circuit between each section of the tuner winding. The edge of the piece of hard rubber should be filed down to a wedge shape to allow it to slip under the spring contacts.

The contacts can be purchased from an electrical supply house or made from brass machine screws by filing down the heads, which should be at least ¼ of an inch in diameter.

The spring contacts disconnecting the dead-end portion are indicated at g (Fig. 1) and also in the detail B (Fig. 2). They should be made of spring brass or phosphor bronze about ¼ of an inch in width. The portion that extends beyond the contact making piece is curved upwards at both edges, thus affording a smooth surface for entry of the hard



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rubber piece, thereby raising the spring off the contact, R. The portion of the spring, A, is doubled back in order that

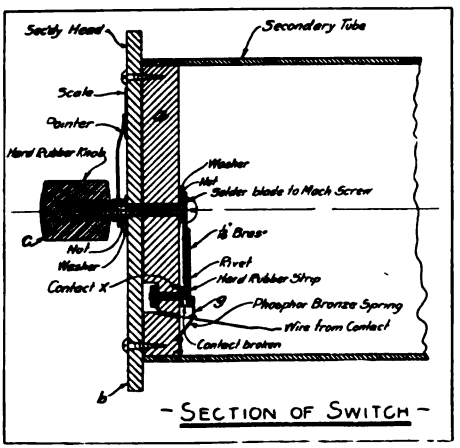


*Fig. 1, First Prize Article*

the contact of the lever may occupy the proper position in respect to the stationary contact. This should be constructed to fall on the contact heads about ⅛ of an inch from the end of the switch blade, as in Fig. 2 A.

To allow short connecting leads to the

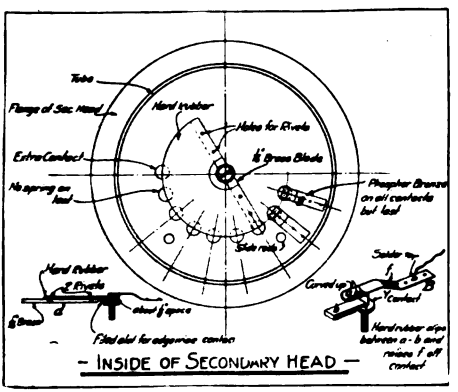


*Fig. 2, First Prize Article*

switch, the switch contacts are arranged on the bottom half of the secondary head. However, they may be arranged either above or below, according to the maker's desire.

With a little patience on the part of the builder this switch can be easily constructed. I believe it will make an improvement in any receiving tuner which operates over a considerable range of wave lengths.

NORMAN R. HOOD, *Iowa.*

## SECOND PRIZE, FIVE DOLLARS
## A ¼ K. W. Cabinet Transmitting Set of Unusual Compactness

The majority of amateurs desire transmitting sets that will take up small space and at the same time will give a high degree of efficiency. A side view of a set of this type is shown in Fig. 1 and a top view in Fig. 2, with the accompanying necessary dimensions. The cabinet may

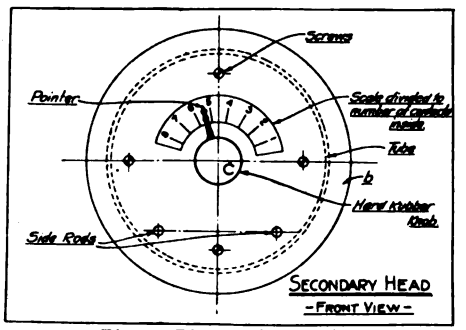


*Fig. 3, First Prize Article*

be either of birch or mahogany and contains the closed core transformer and the high potential condenser. Hard rubber bushings are used to insulate the leads from the transformer to the condenser, while the primary leads are brought out to binding posts on the side of the case.

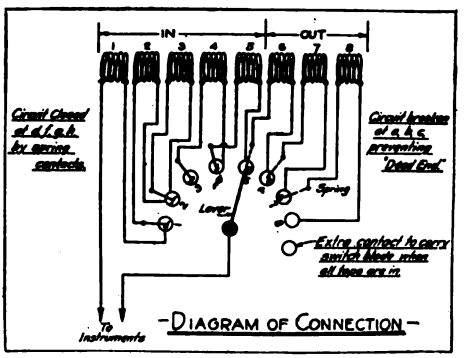
IN
OUT
1 2 3 4 5 6 7 8
Circuit Closed at d, f, g, h, by moving contacts
Circuit broken at a, b, c, preventing "Direct Emf"
Spring
Lever
Extra contact to carry switch blade when all keys are in
To Instruments
DIAGRAM OF CONNECTION

*Fig. 4, First Prize Article*

The condenser is mounted on the opposite end of the cabinet and consists of twelve photographic plates, 8 inches by 10 inches, covered with tinfoil, 6 inches by 8 inches. The plates in the condenser are slid into grooves cut in each side of

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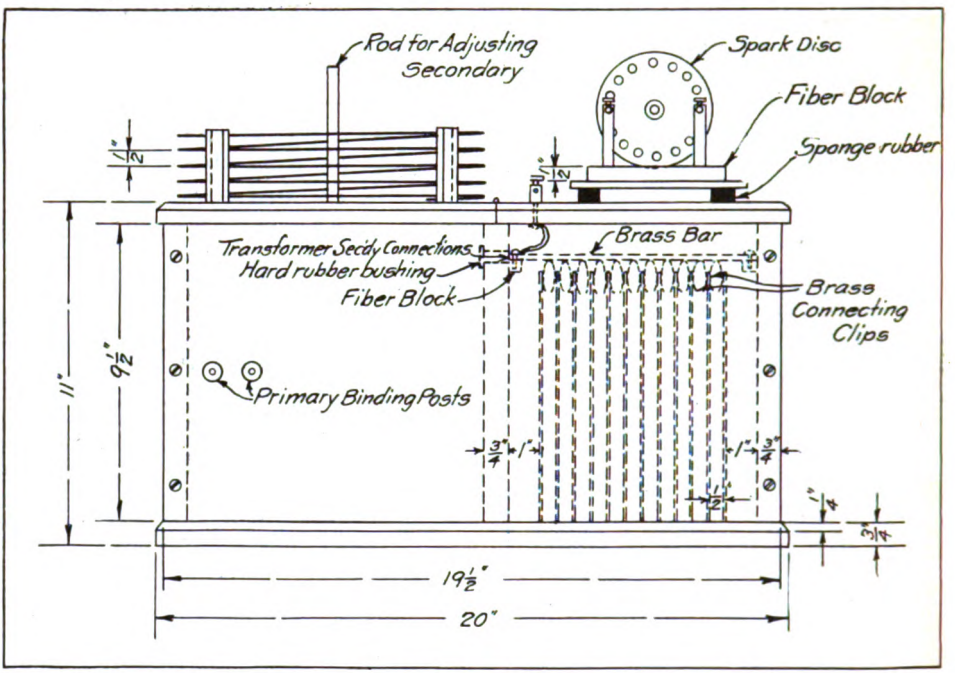


*Fig. 1, Second Prize Article*

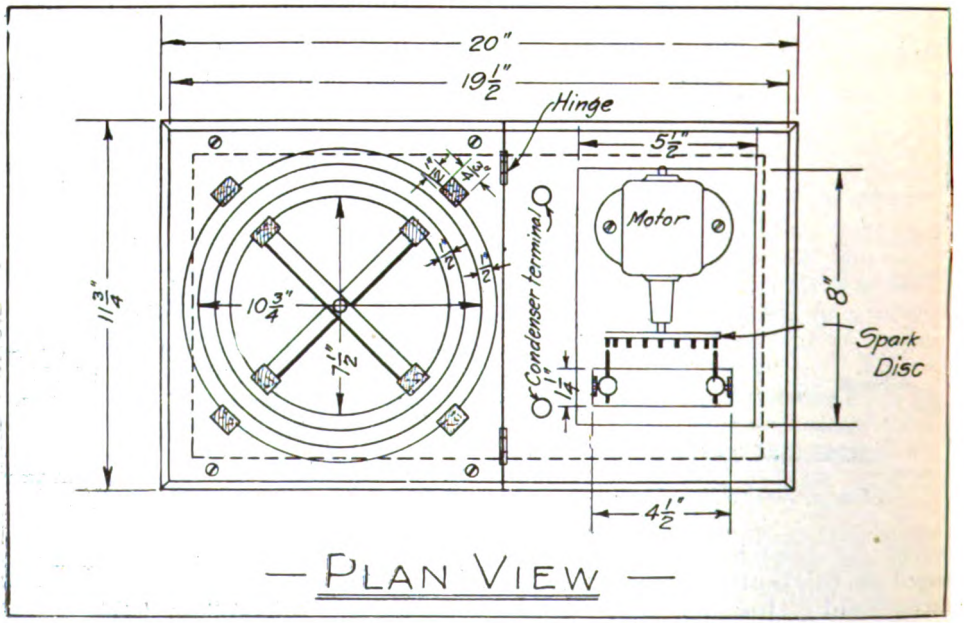


*Fig. 2, Second Prize Article*

the cabinet. Connections are made to the plates by two ¼-inch brass rods with spring brass clips extending down between the plates. The rods are held in position by means of a small block of fibre placed underneath the end of each

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rod. A binding post fitted with a hard rubber bushing is then mounted directly above each rod to which connections are made by a piece of stranded wire which should have sufficient length to al-

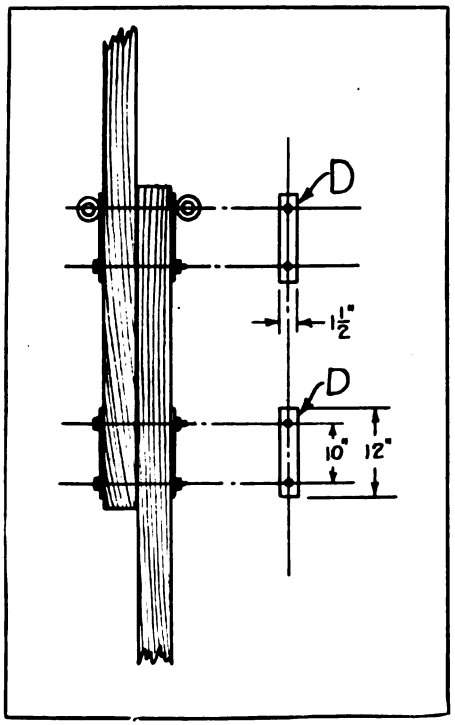


*Fig. 1, Third Prize Article*

low the hinged lid indicated in Fig. 2 to be raised up.

An inductively-coupled oscillation transformer or helix is mounted directly above the transformer. The primary consists of four turns of edgewise wound copper strip, 10¾ inches in diameter, and the secondary of eight turns of the same material, 7½ inches in diameter. The latter is mounted on an upright rod so that the coupling between the windings can be altered as desired.

The rotary spark gap can be of any design suitable to the builder, but the one which I employ has sixteen plugs mounted on a disc 3½ inches in diameter, which in turn is fitted to a 1/20 horsepower motor revolving at the rate of 5,000 revolutions per minute. On each corner of the motor base I glued a piece of sponge rubber about one inch square to absorb all possible vibration.

When the transmitting set is connected up, as per the drawings, it will be found that the connecting leads between the component parts of the transmitting circuit are very short, which will tend to make for efficiency and will allow the full power at a wave-length of 200 meters.

JOHN B. COLEMAN, *Pennsylvania.*

## THIRD PRIZE, THREE DOLLARS

### An Eighty Foot Mast for Long Distance Transmitting

For the amateur who seeks long distance records, a tall and strong mast for support of the aerial wires is essential to success. Here is a description of a com-

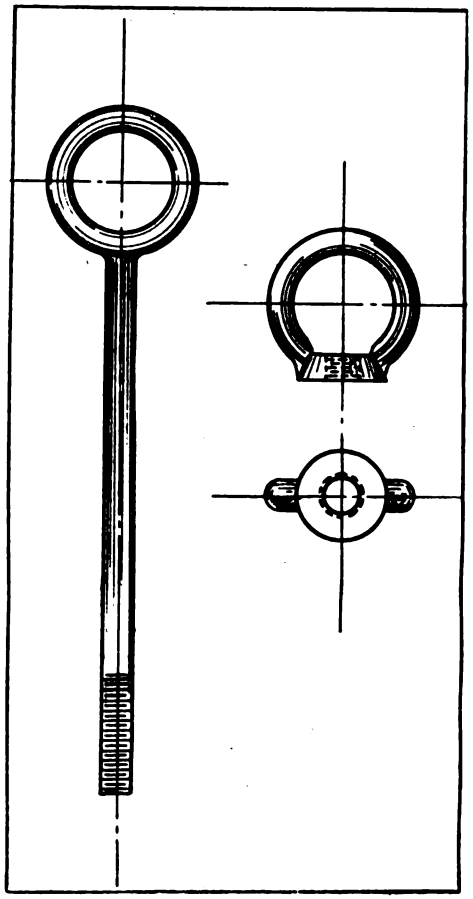

*Fig. 2, Third Prize Article*

pletely satisfactory design suitable for all amateur requirements:

The mast proper is shown in Fig. 8. The following timber is required: One

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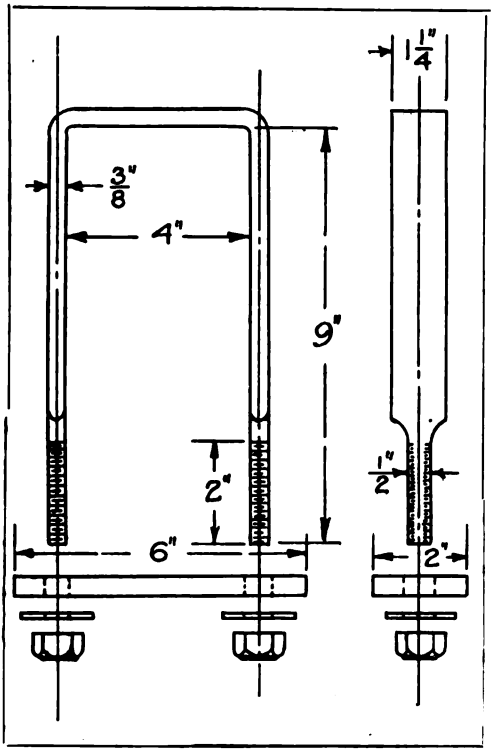


*Fig. 3, Third Prize Article*

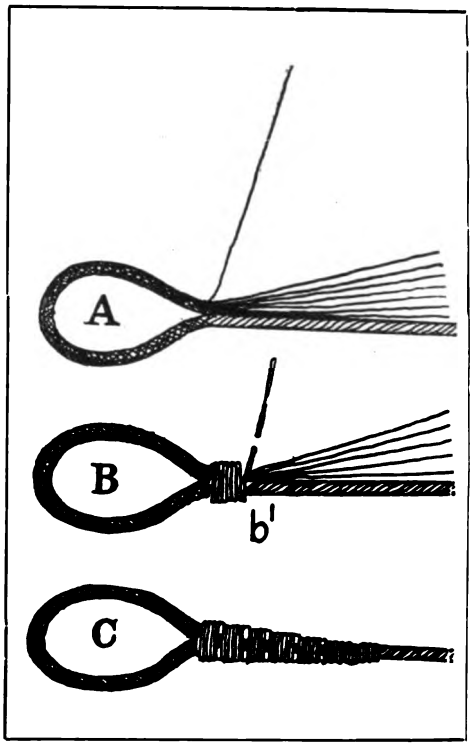


*Fig. 4, Third Prize Article*

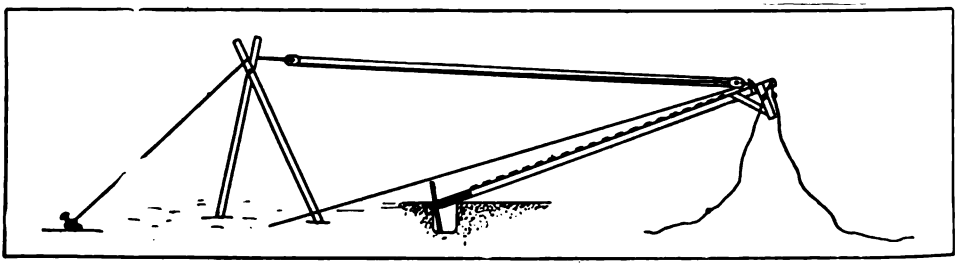

*Fig. 5, Third Prize Article.*

piece, 4 inches by 4 inches by 30 feet; a second piece, 3 inches by 4 inches by 30 feet, and a third piece 3 inches by 3 inches by 30 feet. In the first named piece bore a half-inch hole 16 inches from the end, and 16 inches further down bore a similar hole. Bore a hole of the same size and in corresponding places in the 3-inch by 4-inch by 30-foot piece, and at the opposite end bore four holes as indicated at Fig. 1. At the lower end of the 3-inch by 3-inch by 30-foot piece bore four more holes corresponding to those of the 3-inch by 4-inch by 30-foot piece.

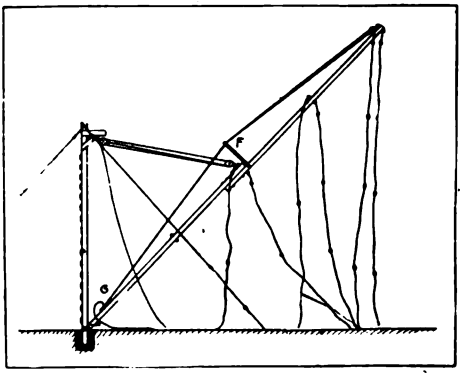

*Fig. 6, Third Prize Article*

Next have a

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blacksmith make five ring nuts, as indicated in Fig. 2; two clamps as shown in Fig. 3, and four iron strips as at D in Fig. 1. The ring nuts are in-

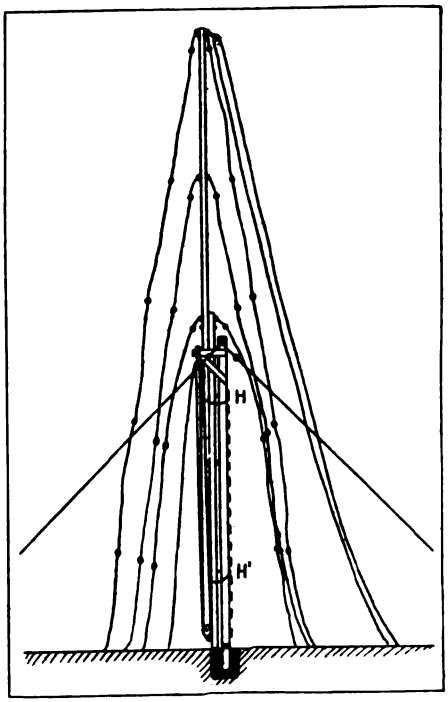


*Fig. 7, Third Prize Article*

tended to take the place of ordinary nuts for the ring bolts. It will be seen that this combination is the means of fastening the guy wires to the mast. The length of the shank of the ring bolt varies, one being 4⅝ inches, the second 3⅝ inches, the third 7 inches and the remaining two 3⅝ inches. These are used for the lower, second center, fourth and top sets of guy wires, respectively, as indicated in Fig. 8. All bolts are ⅜ of an inch in diameter.

The next step in the procedure is to bolt the 3-inch by 4-inch by 30-foot piece and the 3-inch by 3-inch by 30-foot sections together, using three ½-inch bolts, 7 inches in length. In addition, place one ring bolt, using the iron strips in place of washers, thereby considerably strengthening the joints, as shown in Fig. 1.

Returning to the first section: Bore a ⅜-inch hole 3 inches from the top and insert the 4⅜-inch ring bolt, being sure to place it at right angles to the direction of the other bolt holes in this piece (see Fig. 8). Next construct two arms of 2-inch by 4-inch timber, about 2½ feet in length, half lapping their ends and nail them to the 4 by 4, one foot from the top, as shown in Fig. 5. After nailing a sufficient number of strips on this piece, they are ready to be painted. Two coats of a good grade of white paint, allowing plenty of time for drying between the coats, are sufficient.

While the paint is drying, construct the anchors for the guy wires, in the manner shown in Fig. 8, and note especially Fig. 4. Four pieces of wood, 6 inches by 6 inches by 3 feet, are buried to a depth of 3 feet and to these are attached four cables, 7 feet in length. To construct these loops, bend an eye in the cable to the desired size, leaving about 10 inches additional unstranded, as at A (Fig. 4). Then, after bending one of

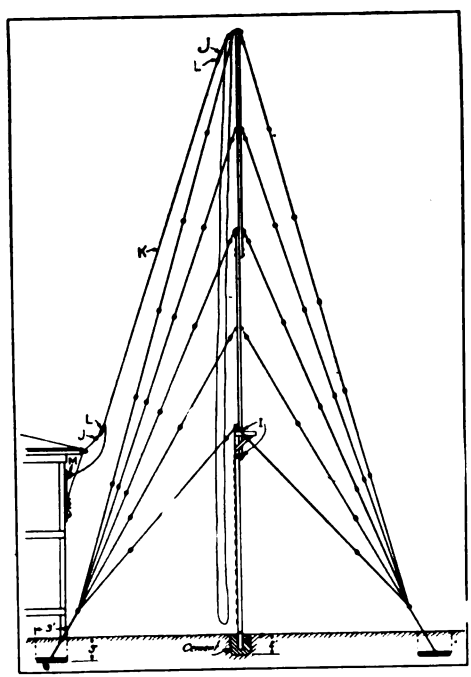


*Fig. 8, Third Prize Article*

these strands at right angles to the cable, wind it tightly about the whole as at E, Fig. 4. At the end of the finished strand (6 feet) bend another at right angles and continue as before until it appears as at C in Fig. 4. With a wire splicer the

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foregoing operation is simple, but the work can be performed satisfactorily

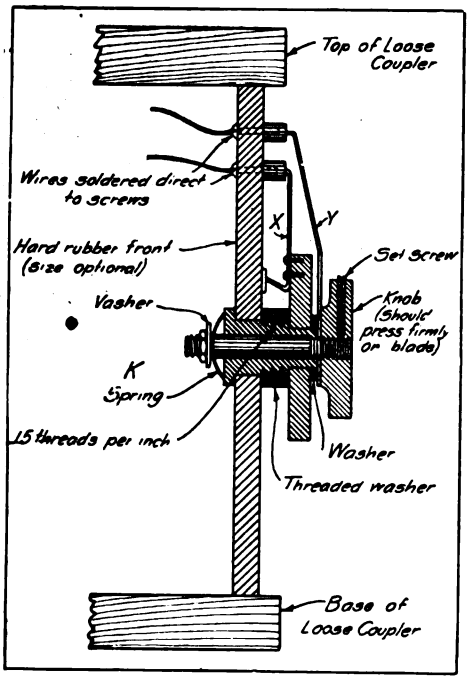


*Fig. 1, Fourth Prize Article*

with a heavy pair of pliers. From the standpoint of cheapness it will be found

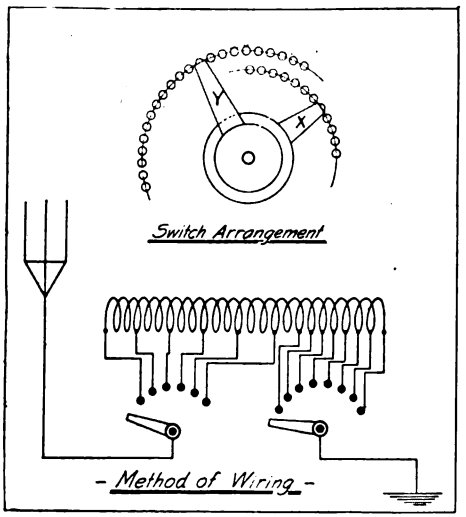


*Fig. 2, Fourth Prize Article*

that a neater or stronger anchor could not possibly be devised.

After digging a hole two feet in depth, the bottom piece is ready for erection. This can be done with the aid of a few young men. Construct a dummy of two pieces, 2 inches by 4 inches by 20 feet in length, bolted together one foot from the top and set up as shown at E in Fig. 5. Place the butt of the piece to be erected over the hole and fasten the blocks to the top of the pole and the

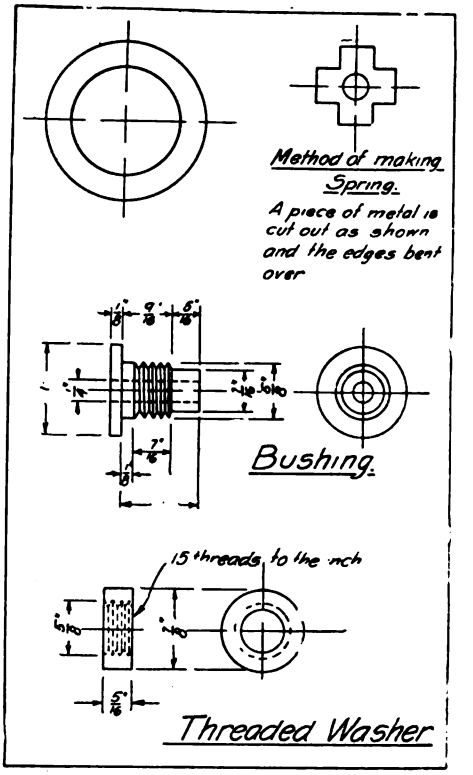
Method of making Spring.
A piece of metal is cut out as shown and the edges bent over
Bushing.
15 threads to the inch
Threaded Washer

*Fig. 3, Fourth Prize Article*

dummy. Then by pulling on the rope haul it up and securely guy it; also surround it with cement at the base.

Now the top mast is erected in a manner similar to the first piece. Before erection, form a truss of the pulley rope by nailing a board, 6 feet in width by 5 feet in length, at the joint of the two top masts and pass a rope over this in a V-shaped groove cut in its end, tying it securely at the base of the section being raised. Note particularly F and G (Fig. 6). With this precaution there is no danger of the section bending dangerously as might otherwise be expected when it

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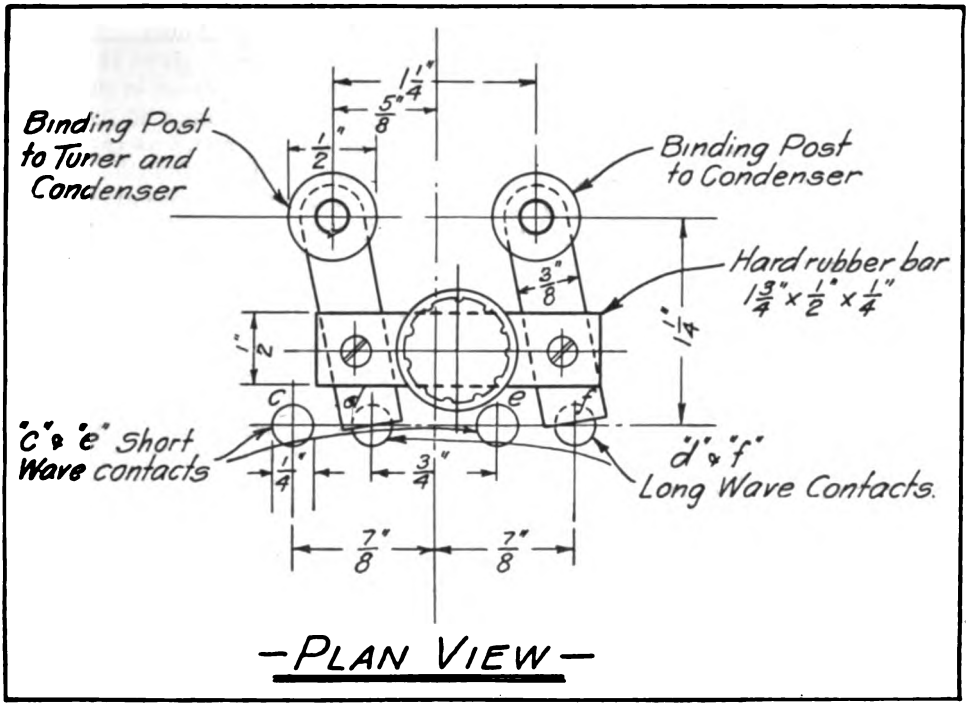


*Fig. 1, Honorary Mention Article, Edwin C. Pantke and Associate*

is being raised from the ground to a vertical position. When the section of the mast has attained the position shown in Fig. 7, fasten two pieces of rope, H and H', about both poles to hold it steady and guard the further erection.

Next climb the pole, remove the temporary truss, F, and place the blocks so that they appear as indicated in Fig. 7, one at the arm and another at the base of the top mast, to be raised. Sufficient competent help should be obtained to assist in raising the upper section. It is absolutely necessary to have a man at each anchor to pay out and control the guy wires as the mast rises. The free ends of the guy wires attached to the top of the center should be securely fastened to the anchor loop to prevent a "runout" and a certain fall at the top mast.

Continue now to haul on the rope and when the pole has reached such a height that the bottom of the top mast is within four feet of the top of the 4 by 4 30-foot piece, pass two ½-inch bolts, 7½ inches long, through their holes, tightening them well.

Now take the iron clamps previously made for the purpose and place them as indicated at 1 in Fig 8; bolt them tight. When this task has been completed, tighten all the guy wires and insert turnbuckles in the top, center and lower sets to take up the slack from time to time. These three sets of wires should not be larger than 7-strand No. 18, heavily galvanized steel cable, and the remaining guys of No. 8 galvanized steel wire. All should have strain insulators every twelve or fifteen feet to reduce the absorption of the radiated energy while transmitting. To insure safety, the guys should be anchored at least 30 feet from the mast.

The experimenter usually has his own ideas regarding the aerial wires, but I might state that I have found that the vertical type, as in Fig. 8, is well suited to amateur transmitting sets. Referring to Fig. 8, J J are the spreaders, each 12 feet in length; K, the aerial wires, of which there are four, each consisting of 7-strand No. 22 copper, 50 feet in length. L L are insulators, preferably of the electrose type, 4 inches in length, and M the lead-in insulator.

FRANK M. O'NEILL, *California.*

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## FOURTH PRIZE, SUBSCRIPTION TO THE WIRELESS AGE

### Details of the Primary Switch for Receiving Tuner

After he has decided to build a receiving tuner along certain definite lines, the amateur experimenter frequently lacks the details of construction for a suitable primary switch to alter the inductance

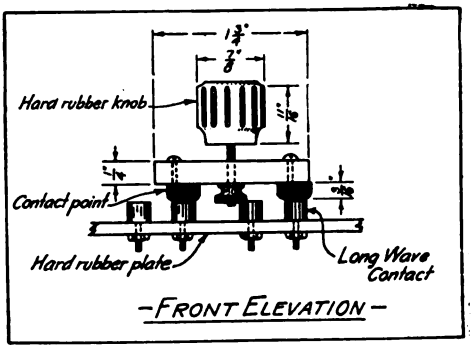


*Fig. 2, Honorary Mention Article, Edwin C. Pantke and Associate*

value a turn at a time. The design for a switch of this type is given in Figs. 1, 2 and 3. Referring to Fig. 2: The switch marked X is employed to cut in a single turn of the primary winding at each point of contact, while the switch, Y, alters the inductance by twelve turns at a time. The amount of inductance which each contact places in the circuit is, of course, optional with the builder, but the one of the dimensions herein given is found suitable for the average run of amateur work.

It will be noted from the side view (Fig. 1) that the blade of the switch, X, presses against a brass ring held in place by two or three machine screws. The end of the switch arm is bent as shown to make contact with the ring. A connection lead extends from this ring to a binding post on the outside of the tuner. An electrical connection is made to the switch, Y, through the brass lever upon which it is mounted. It is preferred that the switch blade be made of either spring brass or phosphor bronze. This statement also applies to the spring, K, which is indicated in detail in Fig. 3. A piece of metal is cut as shown and the edges bent over. The necessary hard rubber knobs can be obtained from the Clapp-Eastham Company, and will fit the size bushing as shown. A detail of the wiring diagram is given in Fig. 2.

If a condenser is placed in shunt to the primary winding, it may be found practical to include as many as two turns to each contact of the switch, X. The first method, however, is recommended, as generally increased strength of signals is obtained when the inductance value is varied by means of inductance alone. Complete details of the bushing are given in Fig. 3. R. NEUPERT, *Pennsylvania.*

## HONORARY MENTION

### An Easy Method for Shifting a Variable Condenser

After the completion of our cabinet receiving set, I and my associates found it necessary, on account of the size of the aerial, to connect a condenser in series with the primary winding, to allow the reception of signals from amateur stations. We often found it desirable to connect this condenser in multiple or across the primary winding, the connections for which were effected by a D.P.D.T. switch. We were not satisfied with the appearance of this switch on polished hard rubber, so we worked out the multiple point switch along the lines shown in Figs. 1, 2, 3 and 4.

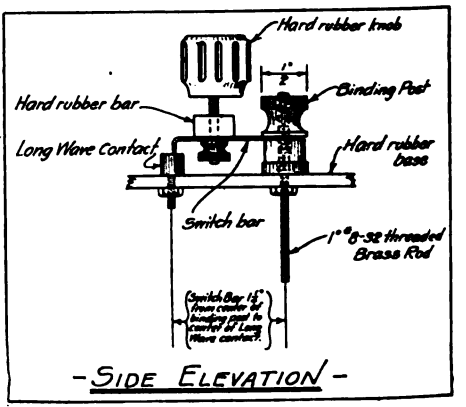


*Fig. 3, Honorary Mention Article, Edwin C. Pantke and Associate*

The binding posts, acting as the pivots on which the switch blades turn, should be of the pattern shown in the W. S. Duck Company's catalogue, page 106, and known as No. 8-X. The 8/32 brass rods should be soldered into the lower half of the binding posts so

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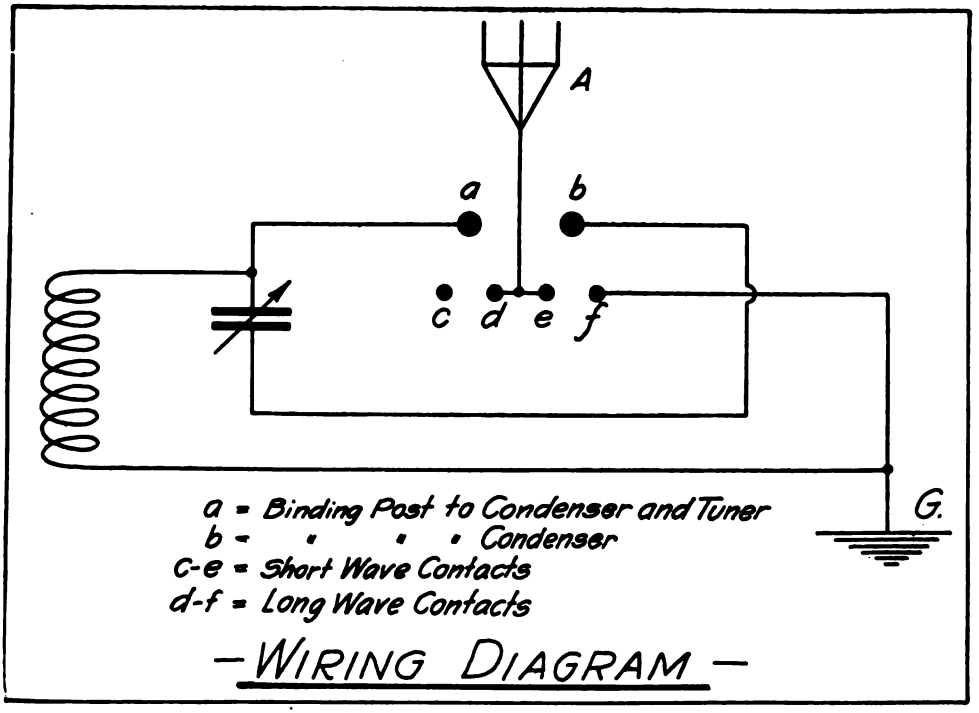


*Fig. 4, Honorary Mention, Edwin C. Pantke and Associate*

that they turn, acting as pivots, although if desired, the blades could be made to turn on the binding posts. It is evident from the drawing that connections to the switch are made from the rear. A satisfactory diagram of connections is shown in Fig. 4. We were well pleased with the appearance of this switch and it is recommended to the amateur field.

EDWIN C. PANTKE AND ASSOCIATE,
*Michigan.*

## HONORARY MENTION

### An Electro Magnetic Aerial Switch

An aerial change-over switch for rapid shifting of the aerial from a transmitting to a receiving position is requisite in any up-to-date station. By using a little ingenuity the parts of apparatus found in any amateur station may be employed to construct a change-over switch operated from a distant control switch. A side view of a complete switch of this type is shown in Fig. 1, a detail of the contact breaker in Fig. 2 and a front view in Fig. 3.

The complete switch when assembled is preferably placed in a vertical position. The control magnet may be of the ordinary sounder type, having a resistance value of, say, ten ohms. The iron core is removed and in place thereof is substituted a sliding core, which is fastened to the levers, L and L-1. These, in turn, are fastened to the blades of the switch proper. When the circuit to the upper magnet is closed, the plunger is drawn in and the switch closed say, for example, to a sending position. When it is desired to receive, the push button of the second magnet is closed and the complete switch is drawn in the opposite direction. It becomes evident at once that the aerial switch may be placed on the ceiling of the room or outside the window, if desired, and operated from the inside as shown.

The two blades of the switch are strengthened by means of the fibre bars in Fig. 3. The terminals of the secondary winding of the oscillation transformer for the transmitting set are connected to the switch contacts, M and M, while the terminals of the primary

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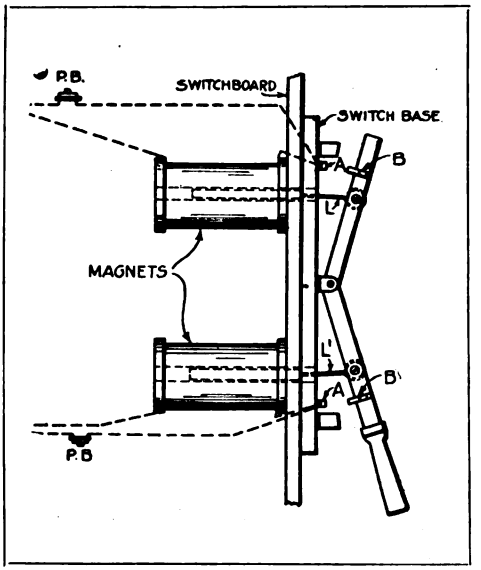


*Fig. 1, Honorary Mention Article, O. E. Cote.*

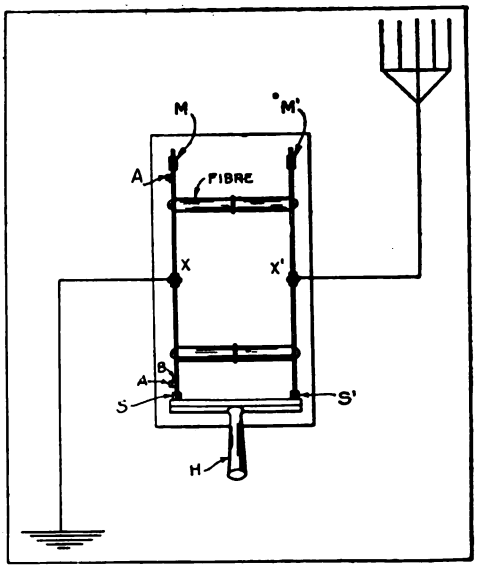


*Fig. 3, Honorary Mention Article, O. E. Cote*

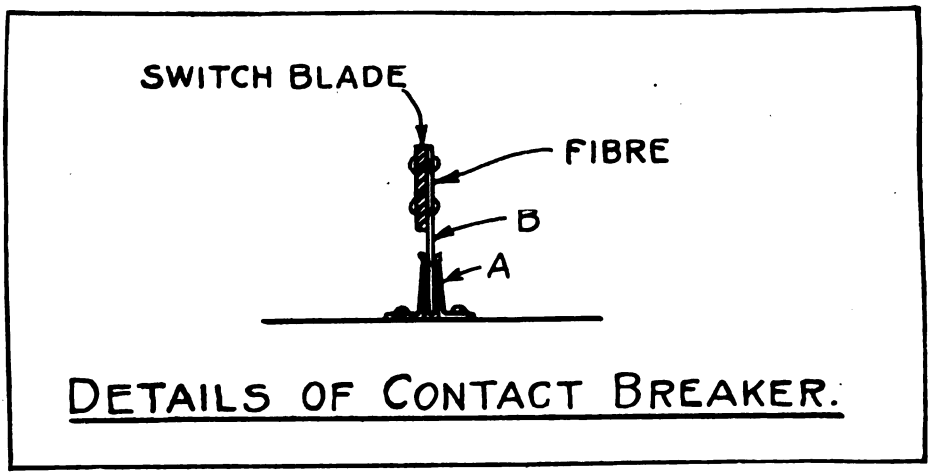


*Fig. 2, Honorary Mention Article, O. E. Cote*

winding of the receiving transformer are connected to S and S. The switch is fitted with a handle, H, so that in case the magnets become inoperative, it may easily be shifted by hand. Strict dimensions have not been given, as they may be altered to suit the needs of the individual builder. It is, however, suggested, in order that the magnets may work freely, that care be taken to see that the parts are not too cumbersome.

I desire also to present to the readers of your magazine details of a slider, which I have found to be particularly effective and sutable for ordinary amateur purposes. The construction should be sufficienly clear from an examination of Figs. 4 and 5.

O. E. COTE, *Rhode Island.*

## HONORARY MENTION
### Good Results Obtained With a Temporary Receiving Aerial

During a recent windstorm which wrecked my aerial, it occurred to me to

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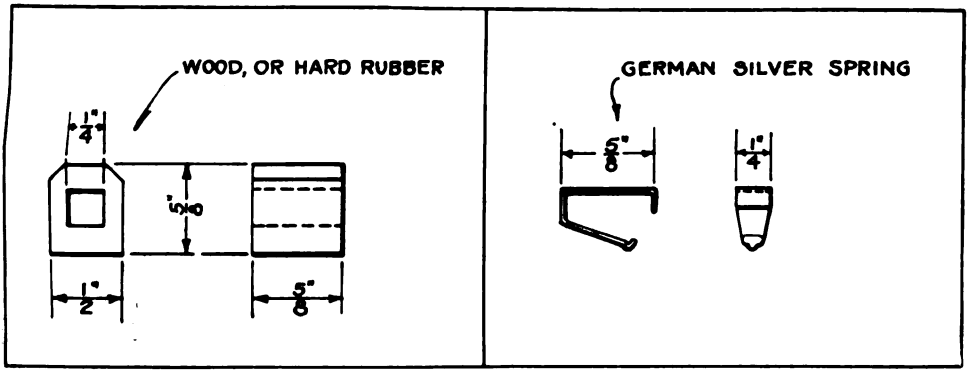
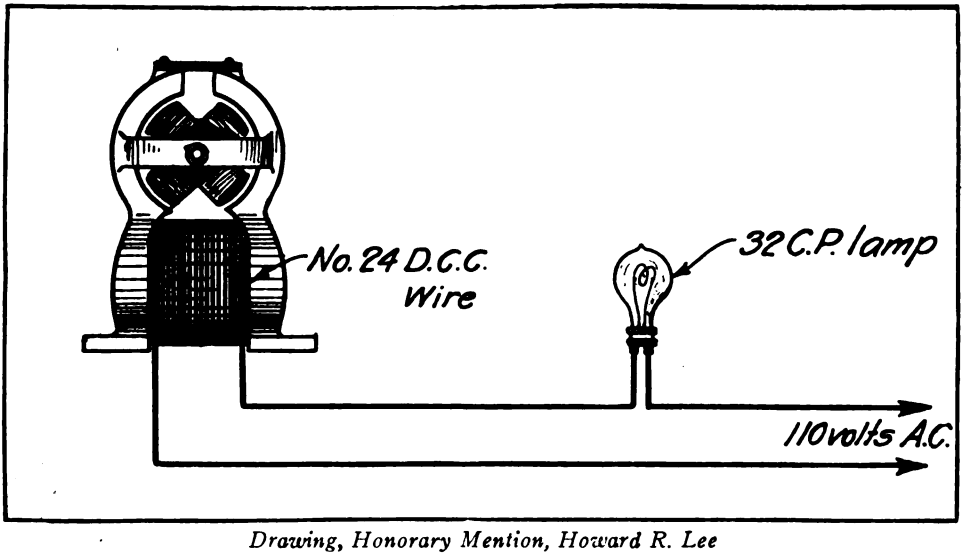



*Figs. 4 and 5, Honorary Mention Article, O. E. Cote*




*Drawing, Honorary Mention, Howard R. Lee*

try out some of the schemes for temporary aerials, that have been described in THE WIRELESS AGE. We have a two-wire bell circuit that is placed the entire length of the house. Despite the fact that the wire is bare in many places and runs parallel to the 110-volt A. C. wires for about ten feet and under the house for six feet, it serves well as an aerial for receiving purposes. With the Armstrong circuit I have heard NAA (Radio, Va., 1,000 miles from here), XAB (Campeche, Mexico), WGV, WRU, WST and WHK, with the head telephones fully two feet from my ears.

Although I have seen numerous descriptions of such aerials and the ranges which have been covered, I do not recollect having read of anyone who has been able to cover an equal distance under the conditions referred to. I am inclined to believe that the energy in the bell circuit is set up by radiation from nearby telephone wires because the latter are at least 50 feet from any point of the bell wire circuit. The total length of the bell wire is about 300 feet.

JOHN M. CLAYTON, *Arkansas.*

## HONORARY MENTION

A simple and efficient motor which will run on 110 volts alternating current can be constructed from an upright battery motor as follows: Remove the brushes, connect segments of commutator together, and rewind field to its fullest capacity with No. 24 D. C. C. copper magnet wire. Connections should be made, as indicated in the accompanying drawing, placing a thirty-two candlepower lamp in series with field and current.

HOWARD R. LEE, *California.*

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**Vessels Recently Equipped With Marconi Apparatus**

| Names | Owners | Call Letters |
|---|---|---|
| Munwood | Munson Steamship Line | KUH |
| Paloma | Munson Steamship Line | XB |
| Standard | Standard Oil Company of New Jersey | KIC |
| Charles Pratt | Standard Oil Company of New Jersey | KSQ |
| Senator Bailey | Gulf Refining Company | KGS |
| Pearl Shell | Pearl Shell Steamship Company | WIC |
| Strinda | Ludwig Mowinckel | LFO |
| Clan Lamont | Clan Line | YON |
| Yaguez | Vacuum Oil Company | (Not assigned) |

## THE SHARE MARKET

New York, February 16.

Trading in Marconi shares has been somewhat quiet during the past month, with American steady between 3⅝ and 4¼.

Bid and asked prices today: American 4-4¼; Canadian, 1⅝-1⅞; English, preferred, 8⅝-11; English, common, 9-12½.

## OBITUARY

### Belvidere Brooks

Belvidere Brooks, vice-president of the Western Union Telegraph Company, died suddenly of heart disease at his home, No. 116 Riverside Drive, New York City, on February 10. Mr. Brooks' career holds unusual interest, as he rose to the office he filled at the time of his death from the position of a messenger boy.

Born in Wheelock, Texas, July 6, 1859, he mastered the Morse code while working in a store and at the age of twelve, entered the telegraph service as a messenger. Afterward he was employed in railroad work. In 1879 he entered the service of the Western Union Telegraph Company as operator, and the following year he was appointed manager of the Navasota, Texas, office. He was appointed manager of the Denver office in 1890, assistant superintendent in 1893, general superintendent of the Eastern Division in 1902, and general manager in 1910, after which he became vice-president.

The funeral services were attended by men prominent in the telegraph world and included Edward J. Nally, vice-president and general manager of the Marconi Wireless Telegraph Company of America.

## DINNER IN HONOR OF DR. PUPIN

At a dinner in his honor on the evening of February 17, at the University Club, New York City, Dr. Michael Idvorsky Pupin, of Columbia, electrical engineer and physicist, was officially notified by the French Academy that the Herbert Prize had been awarded to him for his "Method of Mathematical Analysis of Electrical Circuits," and for his "Discoveries and Inventions in Electrical Resonance, the Tuning of Electrical Circuits, and the Loading of Telephone Lines."

Among those present was Edward J. Nally, vice-president and general manager of the Marconi Wireless Telegraph Company of America.

## WIRES DOWN, WIRELESS IS USED

Marshall, Marin County, California, population seventy-five, became the center of all the wire business of the Pacific Coast for a few days recently. If it had not been for Marshall and Astoria, Oregon, San Francisco, Seattle and Portland would have been in a bad way. All the wires were down. Urgent messages dealing with Alaska had to be transmitted. The Marconi Wireless Telegraph Company of America arranged communications between Marshall and Astoria and an outlet for the traffic was found.

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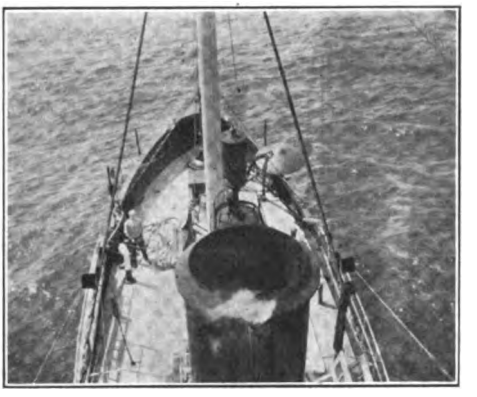
# The Lightship's Far-Flung Signals

**The Story of the Steel-Hulled Guardians of the Sea Coast That Warn the Storm-Bound Ships**

THIS is the season of storms and wrecks at sea, a time of year when probably no wireless stations afloat play so important a part in safeguarding our shipping as those aboard the lightships. The heaviest storms of the entire year sweep the coast during the late winter and early spring months, menacing even the largest vessels. From their lonely stations, standing guard before the danger points or harbor entrances, the lightships are called upon to render invaluable aid which in recent years has been enormously augmented in worth by the installation of wireless apparatus.



*Deck view of the sea guardian, whose warning voice has a range of a hundred miles or more*

A plan to extend these stations by placing wireless equipments upon every lightship along the entire coast line, is now being urged upon the Government, for wireless installations greatly increase the effective radius of the signals of the lightships, and is of course independent of weather conditions.

It comes as a surprise to the layman to learn the actual distances the sea sentinel's warning signals will carry. The most powerful lights upon the ships, for instance, carry about thirteen miles under the most favorable conditions; the submarine signals with which some of the ships are supplied, can be heard perhaps ten miles. Bells and whistles on the other hand can be heard for very short distances when thick weather prevails, or through heavy rains, snow or fog — at times not more than a few yards. The wireless signal in contrast is effective in all extremes of weather and makes possible giving an approaching ship definite information a hundred miles or more in all directions.

It is obvious, therefore, that wireless aboard the lightships is indispensible in safeguarding the lives of all those who go down to the sea in ships. The effective radius of one lightship overlaps that of the next in turn along the coast line, so that it is impossible for a ship to miss their signals. A broard safety zone is thus thrown about the danger points along the coast line. Many a ship in the past has been wrecked due to the inability of her men to read the danger signals thrown out by lighthouses, signal bells or whistles, or because the warning was received too late. Today the captain of an incoming steamer directs his course with perfect certainty and if any doubts arise, his question, asked by wireless, can be answered by the lightship in a few seconds.

Not the least important advantage of the wireless installation aboard the lightships is that communication is thus established without interruption with the land.



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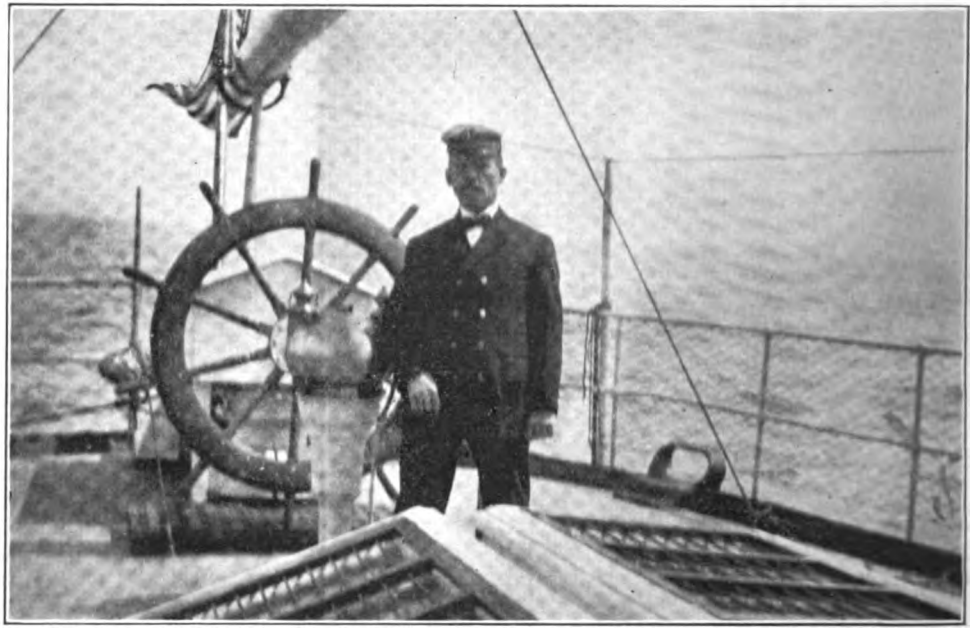
Long before the days of wireless, repeated attempts were made to establish communication with the lightships by means of undersea cables. A cable was laid at great expense to the Nantucket Lightship which is anchored upwards of fifty miles out to sea, but the results were never satisfactory.

The Nantucket Lightship is in reality the point of departure for the great volume of oversea traffic leaving New York. It is the last substantial thing seen of the North American continent for the outward bound passenger and the first bit of America to greet the incoming steamer. The familiar phrase, "passed Nantucket," is flashed thousands of times in the course of a year from the lonely lightship to the shore stations to be repeated throughout the country. By these two words millions of people are rassured that the sea voyage is nearly over and that the friends or the shipments they are expecting are nearing port. And by means of this wireless intelligence, too, they are given ample time to reach the pier from any point within a considerable distance of New York.

The public accepts this wonderful service as a matter of course without realizing the price in human effort, skill and patience which it entails. The wireless operator aboard one of these lightships lives doubtless the most isolated existence in many respects to be found upon the seven seas. He is anchored far out to sea and must carry on his lonely vigil for weeks at a time without relief. His ship sails no regular course and is constantly beat upon by the wind and waves. The lightships are usually of but a few hundred tons' burden and are tossed about like corks. Only the best of sailors can contrive to live aboard. Some idea of the extreme violence of the motion can be gained from the fact that in very stormy weather it is impossible for those on the vessel to eat from tables in the conventional manner. The food is placed in swinging baskets and the crew, holding desperately to some fixed object in the cabin, grab their food as it swings from side to side. Let one's hand slip for a moment, and the body may be thrown violently across the cabin. Under such conditions as these the wireless operator



*Captain of the Diamond Shoal lightship, anchored far out at sea but whose wireless equipment keeps him in touch with all the world's events*

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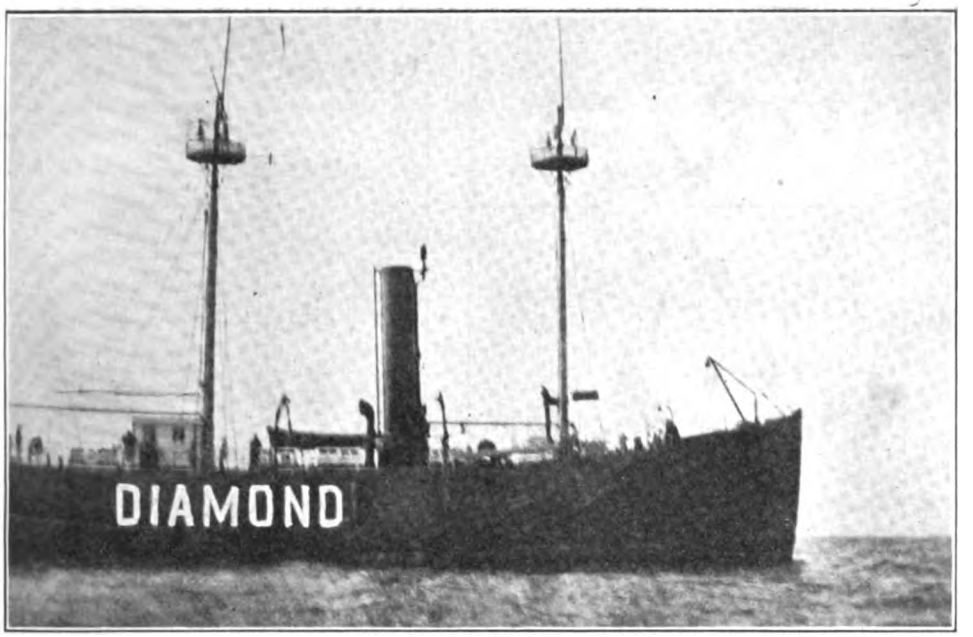


*Lightship No. 71, off Hatteras, showing the two-masted type of vessel whose stout steel hull can withstand the heaviest pounding of the seas*

often must cling to his table and delicately manipulate the complicated apparatus which keeps him in touch with the passing steamships and enables him to throw out signals of danger.

There are compensations, nevertheless, even for the wireless man aboard the lonely lightships. There is scarcely an hour of the day or night that he is not in direct communication with a great steamship bound in or out, and hears the latest news of the ship. He is acquainted with the wireless operators of scores of vessels, so that he is not lacking for society. The news for the ship newspapers which is broadcasted every night from the station at Cape Cod, keeps him informed of the latest happenings of the world, even to baseball scores.

All the lightships along the Atlantic seaboard are of much the same type, whether anchored off Nantucket, the Bay of Fundy or the Diamond Shoals. They have two masts, each with a gallery about sixty feet above the water line. They are built of steel, for only the stoutest hulls can withstand the pounding of the seas in such exposed positions. In recent times these ships have been fitted with engines, so that they may be kept under steam; the engines are of sufficient power to develop a speed of perhaps seven knots an hour. Therefore, in case the ships break loose from their anchorage, which is a common occurrence, they are no longer at the mercy of the waves.

Signaling devices, in addition to the wireless, comprise as a rule, modern lanterns of about one hundred candlepower with the lenses for throwing rays of light of any desired length at regular intervals of time. The powerful whistles are mechanically operated and used in foggy weather. Marconi ½ k.w. sets are used on some of the lightships. The equipment has a range of twenty-five miles and a wave-length of 300, 400, and 600 meters.



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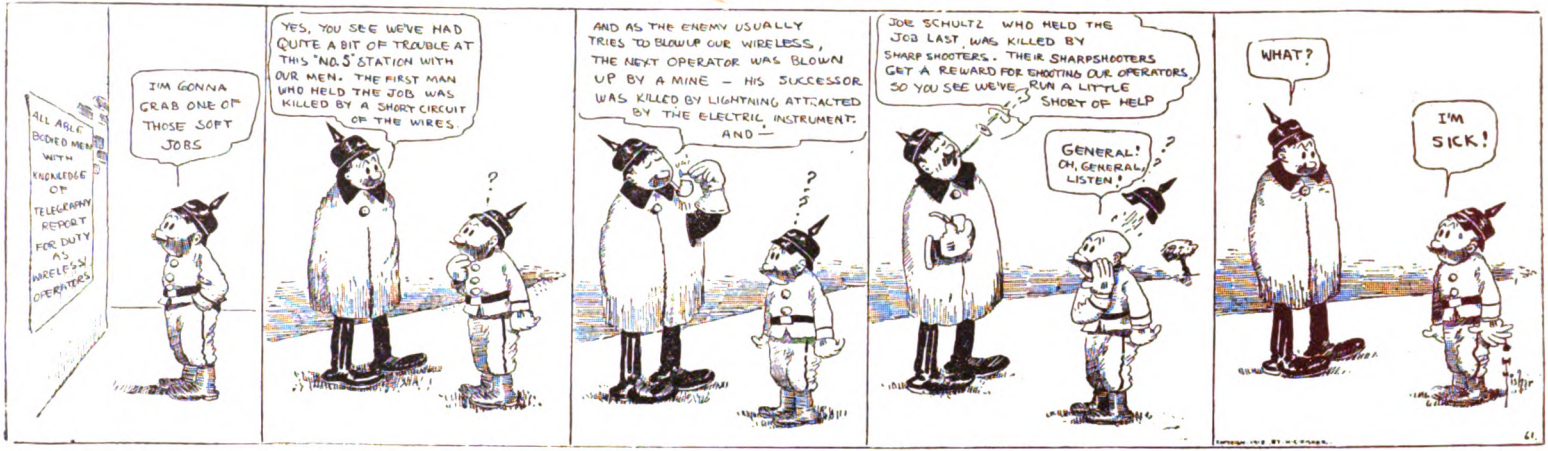
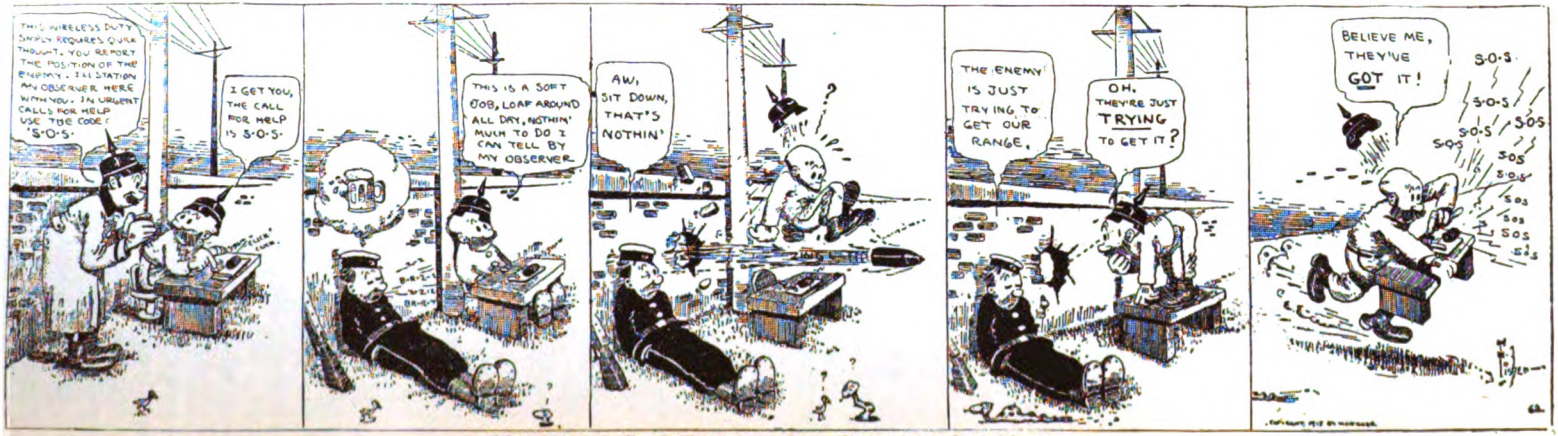
# AN ARTIST'S CONCEPTIONS OF WIRELESS IN WARFARE

*(From The New York World)*


ALL ABLE BODIED MEN WITH KNOWLEDGE OF TELEGRAPHY REPORT FOR DUTY AS WIRELESS OPERATORS
I'M GONNA GRAB ONE OF THOSE SOFT JOBS
YES, YOU SEE WE'VE HAD QUITE A BIT OF TROUBLE AT THIS "NO. 5" STATION WITH OUR MEN. THE FIRST MAN WHO HELD THE JOB WAS KILLED BY A SHORT CIRCUIT OF THE WIRES.
AND AS THE ENEMY USUALLY TRIES TO BLOW UP OUR WIRELESS, THE NEXT OPERATOR WAS BLOWN UP BY A MINE — HIS SUCCESSOR WAS KILLED BY LIGHTNING ATTRACTED BY THE ELECTRIC INSTRUMENT. AND —
JOE SCHULTZ WHO HELD THE JOB LAST, WAS KILLED BY SHARP SHOOTERS. THEIR SHARPSHOOTERS GET A REWARD FOR SHOOTING OUR OPERATORS, SO YOU SEE WE'VE RUN A LITTLE SHORT OF HELP
GENERAL! OH, GENERAL, LISTEN!
WHAT?
I'M SICK!

*Mutt and Jeff—After all, you can't blame Jeff*


THIS WIRELESS DUTY SIMPLY REQUIRES QUICK THOUGHT. YOU REPORT THE POSITION OF THE ENEMY. I'LL STATION AN OBSERVER HERE WITH YOU. IN URGENT CALLS FOR HELP USE THE CODE 'S-O-S.'
I GET YOU, THE CALL FOR HELP IS S-O-S.
THIS IS A SOFT JOB, LOAF AROUND ALL DAY, NOTHIN' MUCH TO DO I CAN TELL BY MY OBSERVER.
AW, SIT DOWN, THAT'S NOTHIN'
THE ENEMY IS JUST TRYING TO GET OUR RANGE.
OH, THEY'RE JUST TRYING TO GET IT?
BELIEVE ME, THEY'VE GOT IT!
S-O-S

*Mutt and Jeff—Jeff knew when the enemy had his range*

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# Queries Answered

**Answers will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all letters and only one side of the paper written on; where diagrams are necessary they must be on a separate sheet and drawn with India ink. Not more than five questions of an individual can be answered. To receive attention these rules must be rigidly observed.**

**Positively no Questions Answered by Mail.**

G. L. W., Austin, Texas, inquires:

Ques.—(1) Where can litzendraht wire be obtained?

Ans.—(1) Communicate with the Belden Manufacturing Company, 23rd Street and Western Avenue, Chicago, Ill.

Ques.—(2) Describe the construction of a billi-condenser and give a diagram of connections for its use with the ordinary receiving instruments.

Ans.—(2) The billi-condenser is nothing more than a variable condenser having a maximum value of capacity of .0001 of a microfarad. It generally consists of two small concentric brass tubes one of which is covered with an insulating material in order that the other may be slid directly over it. By withdrawing the inner tube the capacity of the condenser is readily varied as desired. The billi-condenser is generally connected in shunt to the secondary winding of the receiving tuner; a diagram of connections therefore is unnecessary.

Ques.—(3) What is the fundamental wave-length of an aerial 150 feet in length, 70 feet in height at one end and 60 feet at the other?

Ans.—(3) Approximately 410 meters.

Ques.—(4) If the aerial described is in excess of 200 meters in wave-length how many plates are required in a series condenser to reduce it to 200 meters?

Ans.—(4) This aerial is too large to be reduced to a value of 200 meters. To comply with the restricted wave the flat top portion cannot be more than from 50 to 70 feet in length.

* * *

J. J. V., Elizabeth, N. J.:

You will find the solution of many of your problems in the book "How to Conduct A Radio Club," published by the Marconi Publishing Corporation. Your T aerial has a natural wave-length of 125 meters which can easily be raised to a wave-length of 200 meters by the addition of inductance in the antenna circuit.

We cannot calculate the number of plates for a high potential condenser unless we know the rating in kilowatts and the secondary voltage of the transformer.

We do not recommend the use of an oscillation transformer with a ½-inch or 1-inch spark coil, although it may be employed if desired.

A condenser for amateur purposes can in no case exceed a capacity value of .01 of a microfarad. A condenser suitable for a 3-inch spark coil, also the accompanying oscillation transformer, is fully described in the book "How To Conduct A Radio Club." The actual number of turns to be used and the length of leads connecting the condenser with the spark gap for a 200-meter wave are fully described.

* * *

H. V. R., Jamaica, N. Y., inquires:

Ques.—(1) Please tell me the fundamental wave-length of an aerial 250 feet in length, composed of two wires spaced 12 feet apart. The aerial is of the inverted L type, 60 feet in height.

Ans.—(1) The fundamental wave-length of this aerial is approximately 425 meters.

Ques.—(2) What is the natural wave-length of a second aerial 55 feet in length, consisting of six wires spaced 2 feet apart? It is 60 feet in height on one end and 20 feet in height on the other.

Ans.—(2) The fundamental wave-length of this aerial is approximately 172 meters.

Ques.—(3) Can a rotary spark gap be employed advantageously with a 4-inch coil?

Ans.—(3) A rotary gap is of no value in connection with a spark coil. The spark note of a coil is controlled by the number of interruptions at the vibrator and consequently we see no advantage in fitting a rotary gap.

Ques.—(4) Can signals be received from high-power European stations with the aerial described in my first query, a Poulsen tikker, crystalline detector and loading coils of the correct size to tune to their wave-lengths?

Ans.—(4) You will not be able to copy signals from European stations with the ordinary Poulsen tikker. You require a supersensitive receiving set like that described in "How To Conduct A Radio Club." In this system special circuits are employed in connection with the vacuum valve detector which, upon the correct adjustments, will allow the reception of signals from European stations employing undamped oscillations in broad daylight.

Ques.—(5) Please explain the construction of a Poulsen tikker.

Ans.—(5) The slipping contact type of tikker is the one generally employed. It



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consists of a small brass wheel with a groove, mounted on the shaft of the motor and rotated at a speed of about 1,500 R.P.M. A flexible piece of wire is placed in light contact to the groove and carefully adjusted. This detector occupies the same position in the secondary circuits of a receiving tuner as the crystalline detector, but it is customary to wind the secondary with litzendraht or other wire having a low value of resistance. With this type of detector the condenser in shunt to the telephones should have a high value of capacity, in the neighborhood of .2 of microfarad. Any sort of a mechanical device which will interrupt the circuits of a receiving tuner at a rate of from 300 to 600 times a second will be suitable as a tikker, although that which is described is considered the most practical.

* * *

J. V., Kalamazoo, Mich., inquires:

Ques.—(1) I wish you would tell me how to operate a three-slide tuning coil.

Ans.—(1) With apparatus of this type it is essential that the detector circuit be placed in resonance with the antenna circuit, or at least be so adjusted as to receive the highest possible value of potential from the current flowing in the antenna. Connect the aerial to one slider of the tuner and the second slider to a terminal of the detector. The third slider should be connected through a fixed condenser to the opposite terminal of the detector. The wave-length of the antenna circuit is altered by the first named slider; turns are added or subtracted until the desired station is heard. If you will draw a diagram of connections in accordance with these instructions, you will observe that it is possible to select a number of turns for the detector circuit at some distance from the turns actually included in the primary circuit. In this manner the degree of coupling between the primary and secondary circuits can readily be altered as desired.

Ques.—(2) What is the wave-length of an aerial composed of two No. 14 wires, 135 feet in length with two lead-ins 50 feet in length, the aerial being 50 feet in height on one end and 30 feet on the other?

Ans.—(2) The fundamental wave-length of this antenna is approximately 325 meters.

Ques.—(3) What is the wave-length of the same aerial, 50 feet in height on both ends?

Ans.—(3) Approximately 340 meters.

* * *

O. E. C., Providence, R. I., inquires:

Ques.—(1) Is a carborundum detector more sensitive than an extra good piece of galena?

Ans.—(1) For commercial purposes it is more practical, but not quite as sensitive as a good piece of galena. Occasionally carborundum crystals are found which seem to possess a high degree of sensitiveness and oftentimes are nearly equal to the more sensitive crystals, such as cerusite and galena.

Ques.—(2) How can I construct a potentiometer for use in connection with a carborundum detector, that would not require a space larger than 3½ inches in diameter and two inches in thickness?

Ans.—(2) We advise you construct a potentiometer along the lines employed in the United Wireless type of tuner. A number of graphite resistance rods are mounted in a semi-circle with brass studs which terminate in the points of a multiple-point switch. From ten to fifteen of these studs, each having a resistance of from 15 to 25 ohms, may be employed.

Ques.—(3) How many Columbia dry cells are required for this potentiometer and how long would they last?

Ans.—(3) It is customary to employ three cells in connection with the carborundum detector, although not more than one is required generally.

Ques.—(4) To secure the best result from this detector, please tell me which is preferable; two pieces of carborundum touching each other, or a piece of fine wire in contact with a single crystal.

Ans.—(4) The best results are obtained by the use of a sharp pointed contact pressed tightly against the crystal. Some carborundum crystals require a heavy pressure, while others require an extremely light pressure. It is customary to mount a carborundum crystal in a small brass containing cup with some form of soft metal.

Ques.—(5) What is the average pay of a Marconi operator on board ship and on land stations?

Ans.—(5) Ship operators receive from $25 to $60 a month with a commission on the commercial receipts. Land station operators receive from $50 to $90 a month in the marine division and from $90 to $125 a month in the Trans-Oceanic division.

* * *

L. F., Fort Stanton, New Mexico, inquires:

Ques.—(1) If the only available supply of current is 110-volt direct current, can a Poulsen arc, rated at 3-k.w., be satisfactorily operated on such low voltages for wireless telegraphy?

Ans.—(1) Better results will be obtained with potentials between 500 and 1,500 volts. We have not heard that small arc sets could be operated with stability on 110 volts direct current.

Ques.—(2) If an interrupting device were inserted in the earth connections of an arc set, would resulting signals be audible in a station employing an ordinary type of crystal detector, assuming that the interruptions take place at a rate of, say, 1,000 a second? What is your opinion of the efficiency of such an arrangement?

Ans.—(2) Apparatus has been thus employed commercially, but we have been informed that the range of the set is considerably decreased and that generally only one-fifth of the distance obtainable with the arc set used in the standard manner is secured.

Ques.—(3) With an arc system, why is

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the transmitting key placed directly in the circuit so as to make and break the aerial circuit instead of being operated to make signals by shunting a portion of the aerial inductance, thereby placing the set in and out of tune with the receiving station?

Ans.—(3) It is customary to shunt a portion of the aerial tuning inductance, but in this system unless the receiving apparatus is very accurately tuned, the receiving operator will experience interference from the compensation wave as well as the transmitting wave. In other words, a Poulsen arc transmitter operated in this manner will emit its energy at two wave-lengths and interfere with stations in the vicinity in which the latter equipments are located. When the entire output of the antenna circuit is broken directly, this interference is eliminated and an advantage, of course, is derived, particularly from a commercial standpoint.

* * *

W. C. H., Windrock, Tenn., inquires:

Ques.—(1) What is the natural wave-length of an aerial, 86 feet in height at one end and 59 feet at the other, comprising four No. 12 copper wires spaced 44 inches apart? The flat top portion is 130 feet in length, with a lead-in of 55 feet. The earth wire is 10 feet in length.

Ans.—(1) The wave-length of this aerial is approximately 390 meters.

Ques.—(2) What would be the natural wave-length of this aerial, connected in the form of a loop, with two lead-in wires taken from the two outside wires with a flat top?

Ans.—(2) For receiving purposes it is difficult to estimate the wave-length that may be expected, unless the capacity of the condenser and the dimensions of the tuning coil, which are to be included in series with the loop, are definitely known. Even with this information, the solution is not readily arrived at.

Ques.—(3) Please tell me whether in order to obtain maximum results, it is necessary to place insulators at frequent intervals in the guy wires which support the aerial mast, the aerial being used for the reception of signals only?

Ans.—(3) It is not so important that the guy wires of a receiving station be insulated from the earth as at the transmitting station. If the receiving aerial proper is swung out at a considerable distance from the guy wires, there will be little if any effect. However, if the receiving wires are near to the guy wires, some absorption of the received energy may be expected. To insure the maximum strength of signals, it is advisable to insulate the wires.

* * *

R. C. B., Columbus Grove, O., inquires:

Ques.—(1) What and where are the stations having the call letters BVQ and VPP?

Ans.—(1) We have no record showing that these letters have been assigned.

Ques.—(2) Is it possible to connect up two step-up transformers, one having a voltage of 13,000 and the other 5,000?

Ans.—(2) If desired, the secondary winding of these transformers may be connected in series, but care should be taken to secure the correct polarity so that the voltage of one coil will not oppose that of the other.

Ques.—(3) What is the wave-length of an aerial of the T type, consisting of two aluminum wires 175 feet in length, 70 feet in height at one end, sloping down to 30 feet at the other? It is connected at one end only. Will this aerial be practical for the reception of long wave-lengths at, say, 9,000 meters?

Ans.—(3) The fundamental wave-length of this aerial is approximately 230 meters. With a supersensitive receiving set such as described in "How to Conduct a Radio Club," this aerial will allow the reception of signals at a wave-length of 9,000 meters, but increased results will be obtained if the antenna is changed from the T type to the inverted L type. For the reception of signals at 9,000 meters from very long distances the antenna should be at least 500 feet in length.

* * *

F. R. P., Somerville, Mass., inquires:

Ques.—(1) Is the high potential battery described in the Second Prize Article published in the December WIRELESS AGE entirely practical? What amperage might be expected if the plates were 2 inches by 2 inches? If some of these batteries were connected up in multiple would there be sufficient power to operate a spark coil?

Ans.—(1) The battery described is entirely practical for the purposes for which it was designed. The vacuum valve detector requires an exceedingly low value of amperage in the head telephone circuit and a rather high value of potential. The current output of the battery described in the December issue is of low value and cannot be used for operation of the spark coil.

Ques.—(2) What is the fundamental wave-length of an aerial, 50 feet in height by 50 feet in length, consisting of three wires and a lead-in of 30 feet?

Ans.—(2) The fundamental wave-length of this aerial is approximately 175 meters.

Ques.—(3) Are there any stations in the vicinity of Boston using wireless telephone apparatus? If, so, what instruments are required to receive their conversations?

Ans.—(3) So far as we are aware there are no wireless telephone stations in operation in the immediate vicinity of Boston. A special experimental station is located at Montauk Point, L. I., but we have not been informed that it is in daily operation. A number of scientists in the eastern part of the United States are at present engaged in experimenting in wireless tele-

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phony, but their working hours are somewhat irregular. It is difficult to obtain definite information concerning the wavelengths employed.

Ques.—(4) Will the undamped wave receiving set described in "How to Conduct a Radio Club" give results on the aerial mentioned in question No. 2?

Ans.—(4) It will give good results provided sufficient inductance is added in series with the antenna system to make it responsive to wave-lengths between 7,000 and 10,000 meters. You should experience no difficulty in reading the naval station at Darien, Isthmus of Panama, the arc set at Arlington (Radio, Va.) and the new naval station located at Lake Bluff, Ill.

Ques.—(5) Have you any information concerning the tuner invented by Radio Inspector Gawler?

Ans.—(5) We have received no information concerning this tuner.

* * *

F. E. D., Kansas City, Mo., inquires:

Ques.—(1) What is the natural wave-length of an aerial 125 feet in length, 60 feet in heighth, consisting of four No. 14 copper wires, spaced 3 feet apart?

Ans.—(1) The natural wave-length of this antenna is approximately 340 meters.

Ques.—(2) Please inform me whether I should be able to get the time signals from Arlington with the following apparatus?: An inductively-coupled receiving tuner with a primary winding 4 inches in length by 4½ inches in diameter wound closely with No. 24 S. C. C. wire, the taps taken out to a multiple point switch; a secondary winding 4 inches in length, 3¼ inches in diameter, wound with No. 30 S. C. C. wire, taps taken out at every fifteen turns; a loading coil, 4 inches in length by 5¼ inches in diameter, wound with No. 18 S. C. C. wire with the taps taken out to a twelve-point switch. I also have a silicon detector, fixed condenser and a pair of Brandes navy type head telephones.

Ans.—(2) For the reception of the time signals the foregoing apparatus will undoubtedly allow adjustments to resonance at a wave-length of 2,500 meters. Please take into account that at other schedules throughout the day the Arlington station operates with undamped oscillations at a wave-length in the vicinity of 7,000 meters. Special apparatus, like that described in "How to Conduct a Radio Club," is required for the reception of these signals.

Ques.—(3) Can you estimate my receiving range?

Ans.—(3) At night during the favorable months of the year you should be able to hear stations on the Atlantic and Gulf coasts. Your daylight range is problematical. With a supersensitive receiving set you should be able to hear the Arlington signals in daylight and also those of the high power radio station located at Tuckerton, N. J.

A. P., Santa Maria, Cal., inquires:

Ques.—(1) At present I employ a vertical antenna for receiving purposes, consisting of nine No. 10 aluminum wires spaced 2 feet apart, suspended between the top of a 95-foot pole and the roof of my residence. The antenna is 100 feet in length and the lead-in adds to this 20 feet. The instruments are grounded to a water pipe a few feet distant from them. It is now my plan to install a 1-kw. transmitter. Would you recommend any changes in the aerial? I also intend to extend the height of this pole to 130 feet but owing to peculiar local circumstances this would not increase the length of the lead-in by more than 10 feet. Do you think the antenna would be too large or would it have a natural period in excess of 200 meters? Do you think it would be advantageous to shorten the aerial and change its type to that of an inverted "L"?

Ans.—(1) The fundamental wave-length of the first described aerial is approximately 135 meters which can readily be loaded to 200 meters by the insertion of the secondary winding of the transmitting oscillation transformer. If the aerial is raised to the height suggested the natural period will be in the neighborhood of 180 meters. In the latter case but two or three turns will be required at the secondary winding of the oscillation transformer to raise it to a wave-length of 200 meters. For purposes of transmission we do not see wherein any advantage would be derived by changing this aerial from a vertical position to a horizontal position. If a flat top inverted L type aerial is desired the flat top portion cannot exceed 50 to 70 feet in length by 40 to 50 feet in height in order to be kept within the restricted government wave-length.

Ques.—(2) Is there any material difference between the rotary quenched spark discharger described on pages 201 and 202 of THE WIRELESS AGE for December, 1915, and the type referred to in question 10, page 24 of "How to Pass the U. S. Government Wireless License Examination?" What would be the spark frequency of these gaps operated by current transformed from 110-volt, sixty-cycle source of supply?

Ans.—(2) The rotary quenched discharger described in the December issue is intended to give a high spark frequency from a low primary frequency. Of course the frequency can be increased by an increase of the speed of the disc. As stated by the contributor, at a speed of 1,200 R. P. M that particular type of gap will give six sparks per revolution or approximately 120 per second. Quenching is obtained because the discharge path is exceedingly short.

In the reply given to the tenth query on page 24 of "How to Pass U. S. Government Wireless License Examination," reference was not made to any particular type of spark gap; the statements were intended to apply to any

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type of discharger which gives a high spark frequency. Commercial quenched spark dischargers give a high spark note because the primary frequency is of 500 cycles.

Ques.—(3) Could you approximate my night working range, using the foregoing apparatus?

Ans.—(3) It is very difficult to conjecture your transmitting range for it will depend largely upon local conditions surrounding your transmitting station and also upon the type of apparatus employed at the receiving station. Amateurs in the central part of the United States frequently cover distances of from 600 to 800 miles at night.

Ques.—(4) I have had the following data given me for the construction of a high potential transformer. Ninety-four per cent. efficiency is claimed. It is to be of the closed core type, 8¼ inches by 15 inches outside dimensions; the cross section is 2 inches by 2 inches. The primary winding has four layers of No. 10 D. C. C. B. & S. gauge copper wire of 85 turns each, taps being brought out to a rheostat or reactance coil at each turn. The secondary winding comprises twenty-four flat coils, 2½ inches inside diameter and 6½ inches outside diameter, with a thickness of ¼ of an inch and a spacing of ¼ of an inch. There are 40,000 turns in the secondary. Can you suggest any improvement?

Ans.—(4) The design suggested will give a secondary potential of about 12,000 volts. Apparently no provision has been made for magnetic leakage between the primary and secondary windings. In consequence it may be necessary to insert a reactance coil in series with the primary winding in order to prevent the lights in your house from flickering. You will find that it will be no more expensive to purchase a transformer of this type than to construct it.

Ques.—(5) If two or more duplicate motor-generators, running at identical speeds, are connected in series is the frequency increased in proportion to their number as well as the potential?

Ans.—(5) The frequency is not increased.

* * *

M. A., Cleburne, Texas, inquires:

Ques.—(1) What is the fundamental wave-length of an aerial 112 feet in length, 65 feet in height, composed of four No. 14 copper wires, spaced 3½ feet apart? What would be the wave-length if I employed but two copper wires of the same height placed on 10-foot spreaders?

Ans.—(1) The fundamental wave-length of this aerial is approximately 325 meters. It will be reduced slightly if two wires are employed, say, to 300 meters.

Ques.—(2) An acquaintance has informed me that a fixed condenser is of no value in the receiving circuit and that only variable condensers should be employed. Is he correct?

Ans.—(2) When the receiving detector is of the crystalline type a fixed condenser is employed in shunt to the head telephones. There is little value in having one of variable capacity at that point. The remaining condensers in the circuit should be variable in capacity.

Ques.—(3) Is marble considered a good insulator? I am about to build a switchboard of marble and I wish to know what transformer discharge a slab of marble 1 inch in thickness will stand without leaking.

Ans.—(3) The average run of marble is unsuited for high potential work and should therefore be avoided. Insulating material such as dielecto, bakelite, micarta, etc., should be used.

Ques.—(4) Is a four-wire aerial productive of better results than a two-wire aerial?

Ans.—(4) Not necessarily. The four-wire aerial will have a high degree of conductivity and a slightly increased value of capacity. For receiving purposes two wires will do as well as four.

* * *

L. L., Monticello, Ia.:

Ques.—(1) To what wave-lengths will the following described receiving tuner be adjustable when used in connection with a three-wire aerial, 90 feet in length by 50 feet in height, with a 25-foot lead-in? The primary winding is 4⅝ inches in diameter by 7½ inches in length. The secondary is 3⅞ inches in diameter, wound with No. 30 D. S. C. wire and is 6½ inches in length.

Ans.—(1) The fundamental wave-length of this antenna is approximately 255 meters. The actual range of wave-lengths to which it will be adjustable depends upon the value of capacity used in shunt to the secondary winding. With a variable condenser of small capacity it will be adjustable to wave-lengths of about 3,500 meters.

Ques.—(2) Does this type of transformer represent an efficient design? The primary winding is controlled by two sets of switches; one set takes single turns of wire and the other cuts in groups of eighteen. The secondary winding is controlled by a twelve-point switch. The primary winding has a short wave-length switch.

Ans.—(2) The tuner is apparently well designed and should give good results within the range of wave-lengths suggested.

Ques.—(3) My receiving set consists of a three slide tuning coil, 24 inches in length by 4½ inches in diameter, wound with No. 24 enameled wire. The additional apparatus comprises a crystalline detector, a fixed condenser, Brandes 2,000-ohm superior head telephones. I could distinctly hear an amateur station one half mile away, but one night the signals ceased suddenly and as yet I have not been able to hear him nor could he hear me. I have tried a variety of hook-ups and a smaller tuning coil in place of the large one. My aerial is perfectly insulated and all joints are well soldered. The ground connection consists of a pipe driven into wet ground for a distance of about

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eight feet. What could possibly be wrong?

Ans.—(3) A tuning coil 24 inches in length has sufficient turns for the construction of several amateur tuners. The energy losses on this tuner will be excessive and it is recommended that it be re-designed. For the reception of amateur signals at a wave-length of 200 meters it need not be more than 4 or 5 inches in length. We are unable to state just where the error lies in your receiving apparatus, but there certainly must be an open circuit. Had you supplied us with a correct diagram of connections we might have been able to solve your problem. Look carefully to the connections in the head telephones. See that there are no open circuits in the winding of your receiving tuner and determine with a battery and head telephone whether the fixed condenser is short circuited.

It is rather difficult to estimate the receiving range of your apparatus under the conditions stated. You will, of course, observe that the fundamental wave-length of the receiving aerial is in excess of 200 meters. At night you should be able to hear signals from stations in the Great Lakes district.

Ques.—(5) Can you give me the address of a dealer who handles graphite rods?

Ans.—(5) Communicate with the Joseph Dixon Crucible Co., Jersey City, N. J.

* * *

A. R., Ravenna, Neb., inquires:

Ques.—(1) I have under construction a receiving transformer for long wave reception and desire your opinion in regard to the same. The primary is 9 inches in length, by 6 inches in diameter, covered with No. 22 enameled single silk wire. The secondary winding is concentric. It is wound with No. 30 enameled single silk covered wire and fitted with a special dead end eliminating switch. Would such a tuner operate satisfactorily and what is its wave-length on the average aerial? How many points should the secondary have?

Ans.—(1) We do not advise the use of enameled wire in the primary or secondary windings of a receiving tuner. Single silk covered wire is preferred. The primary winding is preferably covered with No. 24 wire, but No. 30 is quite correct for the secondary. It is difficult to estimate the wave-length to which this tuner will be adjustable without data concerning the capacity of the condenser to be connected in shunt to the secondary winding. If, however, the secondary winding is, say, 5½ inches in diameter by 8 or 9 inches in length, with a fair sized condenser it should be adjustable to wave-lengths of approximately 6,000 meters. The taps of the secondary should be divided between the points of a 15-point switch.

* * *

D. G. C., Grosse Point, Mich., inquires:

Ques.—(1) What is the difference between the ordinary signals emitted from any wireless telegraph transmitter and the "continuous wave train" sent out by Sayville and other stations?

Ans.—(1) The points of difference between these two systems are fully described in text books on wireless telegraphy. The ordinary spark transmitter sends out damped waves; that is to say, for each spark discharge at the transmitter there flows in the antenna circuit a series of high frequency oscillations of the decaying amplitude. At the finish of each spark discharge the oscillations, of course, cease. In a continuous wave system there is no damping; that is to say, the oscillations do not decrease in amplitude nor are there any interruptions in their production. Continuous waves can be generated by the Goldsmith high frequency alternator, the Alexanderson High Frequency Alternator, the Poulsen arc, or by a battery of vacuum valves.

Ques.—(2) What kind of apparatus is required to receive these signals?

Ans.—(2) Either a tikker, a slipping contact detector, or an oscillating vacuum valve.

Ques.—(3) What is an oscillating vacuum valve and where can one be obtained. Are they expensive?

Ans.—(3) The oscillating valve is well described in "How to Conduct a Radio Club." A complete vacuum valve set can be constructed for sums ranging from $40 to $60.

Ques.—(4) On what wave-length do Tuckerton, Sayville and Nauen usually operate?

Ans.—(4) The wave-length of Tuckerton is 8,000 meters, the call letters WGG. The wave-length of Sayville is 8,400 meters; the call letters are WSL. The Nauen station usually operates at a wave-length of 9,400 meters, but it is frequently changed. The call letters are POZ.

* * *

M. A. C., Cuenca, Ecuador, inquires:

Ques.—(1) Please tell me the wave-length of my aerial. It consists of five aluminum wires, spaced one foot apart. It is 60 feet in length by 50 feet in height.

Ans.—(1) The natural wave-length of this antenna is approximately 200 meters.

Ques.—(2) What advantage is gained by the use of the compressed air spark gap?

Ans.—(2) The compressed air gap has greater self-restoring insulating qualities and produces a more disruptive spark discharge, which may result in increased amplitude of the initial oscillation per wave train.

Ques.—(3) If an aerial is situated on the point of a hill, should its height above the base of the tower be taken into consideration or is the height of a hill an important factor?

Ans.—(3) In the calculation of wave-lengths the height of the antenna above the base of the tower alone would be taken into consideration.

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B. C., Los Angeles, Cal.:

The diagram of connections for the oscillating vacuum valve was given in the National Amateur Wireless Association Bulletin for December, 1915.

The telephones with mica diaphragm will give approximately twelve times the strength of signals obtained with the ordinary telephones.

The receiving range of the apparatus you describe is problematical, depending upon the power of the wave-length of the station from which you expect to receive.

Concerning the effect of compressed air on a spark gap, see answer to the second query of M. A. C. in this issue.

It is not always considered advisable to load the primary and secondary windings of a small receiving tuner to obtain the longer range of wave-lengths. It is desirable to reconstruct the entire windings, giving them sufficient inductance values to obtain the necessary wave-length adjustment. Long distance receiving apparatus is fully described in "How to Conduct a Radio Club."

* * *

R. N. C., Chicago, Ill.:

An impedance coil for the open core transformer may have the same dimensions as the present primary windings. It should be fitted with variable tap-offs brought out through a multiple-point switch.

A condenser for operation on the 200-meter wave should have a capacitance between .008 and .01 of a microfarad. Your condenser plates, 8 by 10 inches, coated with tin-foil 6 by 8 inches, will have a capacitance each of .0006 of a microfarad. Fourteen or fifteen plates, connected in parallel, will be sufficient for operation on the 200-meter wave.

The fundamental wave-length of your aerial is about 230 meters, which is above the government restriction for operation at a wave-length of 200 meters.

Your query concerning the measurement of the logarithmic decrement is fully answered in "How to Conduct a Radio Club." The decrement measurement is, in reality, a percentage indication of the energy losses in a circuit of radio frequency. It also enables the experimenter to determine the number of complete oscillations flowing in the antenna circuit per single spark of the transmitter and therefore allows an estimation of the tuning qualities of the latter.

* * *

S. A. C., Springfield, Mass.:

With proper care and subsequent adjustment the crytaloi detector is said to be very sensitive and will remain in adjustment for an indefinite period. It consists essentially of a specially treated crystal of galena in contact with a mixture of filings, the latter consisting largely of scrapings from galena crystals.

Regarding the receiving tuners described, we prefer the first design, which is a primary winding, 7½ inches in length by 6 inches in diameter, wound with No. 26 D. C. C. wire, and the secondary 7½ inches in length by 5⅛ inches in diameter, wound with No. 32 D. S. C. wire. Enameled wire is not recommended. Your aerial, 125 feet in length by 35 feet in height, has a fundamental wave-length of approximately 285 meters.

We cannot estimate the range of wave-lengths to which the receiving tuner is adjustable unless we know the capacity of the condenser connected in shunt to the secondary winding. With a small variable condenser, such as is supplied to the amateur market, your tuner should be adjustable to wave-lengths in the vicinity of 5,000 meters.

* * *

E. F. T., Charleston, S. C.:

The fundamental wave-length of your aerial, 100 feet in length with an average height of 65 feet, is approximatelv 315 meters.

The diagram for the units and tens switch accompanying your queries is quite correct and will permit the desired variation of inductance. Connect the earth lead to the unit switch and the antenna lead to the tens switch.

It is not practicable to connect two receiving sets to a single aerial under the average conditions. Results can be obtained, but the tuning on one set will effect the resonant adjustment of the other set.

* * *

D. S. C., Glensummit Springs, Pa.:

Your aerial, 70 feet in length by 50 feet in height, has a natural wave-length of 219 meters and will require a series condenser for reduction to the fundamental wave-length of 200 meters. Four plates of glass, connected in series, having dimensions 8 inches by 8 inches, covered with foil 6 inches by 6 inches, will give the required value of capacity. Turns should then be added at the secondary winding of the oscillation transformer until a wave-length of 200 meters is obtained.

Take into consideration that the Arlington and Key West stations operate at certain periods with undamped oscillations. Special apparatus, such as described in "How to Conduct a Radio Club," is required for the reception of these signals. A receiving tuner for use with crystalline detectors and particularly applicable to reception of the time signals from Arlington is described in the National Amateur Wireless Association Bulletin for February, 1916.

Six or eight strands of No. 12 wire will take the place of a single No. 4 B. & S. wire for an earth connection.

The dimensions for a receiving tuner suitable for adjustment to 2,500 meters, is given on page 214 of the December, 1915, issue of THE WIRELESS AGE, under F. C. T.'s inquiry.

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D. J. C., Sioux City, Ia., inquires:

Ques.—(1) My aerial is 150 feet in length, 60 feet in height at the top end and 43 feet in height at the lower end. The wires are spaced 2½ feet. Approximately, what is the fundamental wave-length?

Ans.—(1) The natural wave-length of this antenna is approximately 375 meters.

Ques.—(2) Is the spacing between wires sufficient?

Ans.—(2) There is no advantage in increased spacing.

Ques.—(3) Will an E. I. Company's ½-k.w. coil, connected to an electrolytic interrupter, be sufficient to charge this aerial?

Ans.—(3) If an oscillation transformer and condenser of suitable dimensions are supplied, there will be no difficulty in radiating energy near to the fundamental wave-length of the aerial. You of course understand that this antenna is too large to be operated at the restricted wave-length of 200 meters.

Ques.—(4) Approximately, what is the transmitting range with the ½-k.w. coil and a fixed spark gap?

Ans.—(4) Operating near the fundamental wave-length of the antenna, you should have no difficulty in covering, say, 300 or 400 miles at night time, during the favorable months of the year. Your daylight range is from thirty to sevnty-five miles, depending of course upon the type of receiving apparatus used at the receiving station.

Ans.—(last query) Your receiving range is problematical. During the night time you may be able to hear signals from stations 1,000 to 1,500 miles distant. During the daytime, you will have to rely on local amateur stations.

* * *

R. C., Baltimore, Md.:

You should have no difficulty in receiving signals from the spark station at Key West, Fla., with the receiving apparatus you describe, provided you employ a supersensitive apparatus, such as the vacuum valve amplifier. Your receiving aerial has a natural wave-length of 143 meters, which of course cannot be expected to give the strength of signals that might be obtained with an antenna of increased dimensions.

You should reconstruct your receiving apparatus for the reception of Sayville signals. You are referred to "How to Conduct a Radio Club" for the solution of your problem in this respect.

* * *

F. P., Hingham Center, Mass., inquires:

Ques.—(1) I employ a 250 watt transformer for transmitting. When a pointed gap is placed in the aerial circuit a spark about ¼ of an inch in length may be obtained, while the hot wire ammeter registers ¼ of an ampere. If a gap ¼ inch in length represents a voltage of at least 4,000 volts, I do not understand why it seems as though I obtain more watts than I started with.

Ans.—(1) You can not possibly obtain a higher wattmeter reading in the antenna circuit than you supply to the high potential transformer. The seeming inaccuracy is due to the high mechanical period of the mechanism of the meter compared to that of the wave trains, and the matter is so completely covered on pages 925 and 926 of the September, 1913, issue of this magazine that you are advised to secure a copy of it.

Ques.—(2) Should a high frequency ammeter register the same as a direct current ammeter on the same direct current circuit?

Ans.—(2) If the hot wire ammeter is properly constructed it should give the same reading on direct current as the direct current ammeter.

Ques.—(3) I have great trouble in measuring the wave-length with the open circuit of my transmitting set, and also in trying to make my wave-meter circuit vibrate. I can measure the closed circuit with ease, but when I try the open circuit I can hear the buzzer all over the meter, even when I place the wave-meter at such a distance that the buzzer is hardly audible. Sometimes changing the position of my hand changes the intensity of the signals. Is this the electrostatic action? Can you suggest some remedy? See drawings which I sent you.

Ans.—(3) After careful consideration of your diagram we are of the opinion that you are not thoroughly familiar with the operation of the wave-meter. In previous issues of THE WIRELESS AGE, particularly in the articles under the heading, "Operators' Instruction," complete instructions regarding the subject have been published. We observe in one of your drawings that you have the buzzer for setting the wave-meter into excitation connected directly in series with the inductance coil, and condenser of the wave-meter, which, of course, makes the wave-meter totally inoperative. To measure the open circuit of this aerial connect a small spark gap in series and energize it by, say, a 1-inch spark induction coil. You should then place the crystal detector and head phone in series with each other, and the two in shunt to the variable condenser of the wave-meter. The inductance coil of the wave-meter should then be placed in inductive relation to the earth lead of the antenna system, and by proper adjustment of the detector and variation of the condenser of the wave-meter the point of resonance is readily located. In the February, 1914, issue of THE WIRELESS AGE you will find under the heading, "Operators' Instruction," complete advice for determining the wave-length of the receiving circuit, and also a method for exciting the wave-meter by a battery and buzzer to make it a miniature transmitting set.

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# SPECIAL EXTENSION NOTICE

## Announcement and Application Blank

# National Amateur Wireless Association

**CHARTER MEMBERS ACCEPTED TO MAY 1, 1916.**

So that clubs may have time to complete organization work now under way, and also to give ample opportunity to all who wish to become Charter Members, an extension has been allowed by the Officers and applications will be received up to May 1, 1916. After this date the Initiation Fee of $1.00 will be required from all new members.

### OFFICERS OF THE ASSOCIATION.

PRESIDENT, Guglielmo Marconi.

NATIONAL ADVISORY BOARD OF VICE PRESIDENTS

Professor Alfred N. Goldsmith
College of the City of New York, Institute of Radio Engineers.

Professor Samuel Sheldon,
Polytechnic Institute of Brooklyn.

Professor A. E. Kennelly,
Harvard University.

Professor Charles R. Cross,
Massachusetts Institute of Technology.

Hiram Percy Maxim,
President, American Radio Relay League.

Major William H. Elliott,
Adjutant General Junior American Guard.

Capt. W. H. G. Bullard, U. S. N. Superintendent, U. S. Naval Radio Service.

Col. Samuel Reber, U. S. A., Chief Signal Officer U. S. Army.

E. E. Bucher, Instructing Engineer, Marconi Wireless Telegraph Company.

ADMINISTRATIVE OFFICERS:

ACTING PRESIDENT,
J. Andrew White,
Editor, THE WIRELESS AGE.

MANAGING SECRETARY,
Clayton E. Clayton,
450 4th Avenue, New York.

A national organization of wireless amateurs was announced in the October, 1915, number of THE WIRELESS AGE. Further details of the organization are given in an address made by J. Andrew White, which was published in the November WIRELESS AGE. Reprint copies sent upon request.

### ENROLLMENT OF CHARTER MEMBERS.

Charter members of the National Amateur Wireless Association will be enrolled on special arrangement. Charter members will receive the following:

### CHARTER MEMBERS' EQUIPMENT.

**1st. CERTIFICATE OF MEMBERSHIP.**

The handsomely steel-engraved Certificate, with shadow background half-tone, is sealed and signed by Officers, with the endorsement of Senatore Marconi, as President. Every member will want to frame and place it alongside of his Government License certificate, two documents establishing status as wireless amateurs.

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**2nd. AERIAL PENNANT.**

The 36 inch aerial pennant, painted in four colors on scarlet felt, will stand long service at your aerial mast head. Every member will be proud of the National Insignia flying from his aerial.

**3rd. MEMBERSHIP PIN.**

The National Amateur Wireless Association Pin in gold and enamel is the National emblem of the Association. The design shown on this page can but faintly describe its handsome appearance in three colors and gold. The pin has a special patented hub and shank which permits it being securely fastened on the coat lapel or on the vest without turning upside down.

**4th. HOW TO CONDUCT A RADIO CLUB.**

This splendid book, which has been months in preparation and incorporates portions of articles running under the same title in THE WIRELESS AGE, is re-written to cover every new development, and with a large proportion of new matter. It is the foundation stone of the National Amateur Wireless Association activities. Price of this book 50c.

**5th. LIST OF RADIO STATIONS OF THE WORLD.**

Revised Edition just published. See advertisement. Regular 50c edition.

**6th. HOW TO PASS U. S. GOVERNMENT WIRELESS LICENSE EXAMINATIONS.**

Regular 50c edition of this popular book. Members who already have a copy, see concessions below.

**7th. MONTHLY BULLETIN SERVICE.**

It is intended to make the monthly bulletin service for members of the National Amateur Wireless Association one of the most important features of the Association. This bulletin is to be used in connection with "List of Radio Stations of the World" described above. It will carry all additions (both amateur and commercial) to "List of Radio Stations of the U. S.", issued by the Bureau of Navigation, U. S. Department of Commerce, and secured for members at 18c a copy. It is issued only once a year. The Association Bulletin will keep both lists up to date for you month by month, and in addition, will carry other special and invaluable Association features not obtainable elsewhere.

**8th. ONE YEAR'S SUBSCRIPTION TO THE WIRELESS AGE.**

THE WIRELESS AGE becomes the Official Organ of the National Amateur Wireless Association and will contain full reports of wireless amateur activities, both national and local. It is planned to give published recognition to individual amateur achievement.

## CONCESSIONS:

Those who, *during the past six months,* have become subscribers to THE WIRELESS AGE, or have renewed their subscription, or have purchased any portion of the Charter Membership Equipment, may consider such payment as partial payment of Charter Membership Application as given below. If you have paid for a subscription to THE WIRELESS AGE which includes books which are not a part of the Membership Equipment, then you may credit $1.25 of the remittance as partial payment on the Charter Membership. For example, you may have remitted $2.25 for the combination offer of the 1915 Year Book with one year's subscription to THE WIRELESS AGE. In this combination, the price of both the book and the subscription was reduced, to make the special offer; therefore, you may be credited only with that part of the payment which went to the magazine—that is, $1.25. Coupon subscribers receive no credit for trial orders. Subscribers to THE WIRELESS AGE who *began or renewed more than six months ago,* will secure through full Charter Membership fee a renewal for another year; and their subscriptions will be extended for one year from the time the present subscription expires.

## ANNUAL DUES FOLLOWING FIRST YEAR.

The annual dues are to be not more than $2.00, after the first year. For this, all members are to receive:

1st. The Monthly Bulletin Service.

2nd. THE WIRELESS AGE for one year.

3rd. Special 50c. Instruction Books at 30% off list price.

4th. 10% discount on any book on wireless published, and other features to be announced later.

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**SPECIAL NOTICE REGARDING CORRESPONDENCE.**

As the National Amateur Wireless Association is in no sense a money making enterprise, and as the nominal dues will cover a very small amount of handling expense, it is desired that the correspondence be limited to only the most essential necessities. Many general questions will be answered in the Service Bulletins; special matters pertaining to local questions should be handled through the Corresponding Secretary of Local Clubs and Associations. A cordial invitation is extended to all club officials to write on matters pertaining to organization. This invitation also includes those who are interested in starting new clubs.

**Clayton E. Clayton, Managing Secretary,**
**450 4th Ave., New York.**

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**Checks and money orders should be made payable to: Natl. Amateur Wireless Assn.**

## APPLICATION FOR MEMBERSHIP.

CLAYTON E. CLAYTON, Managing Secretary,
NATIONAL AMATEUR WIRELESS ASSOCIATION, Date.....
450 4th Avenue, New York City.

As I desire to receive full recognition as an amateur wireless worker of the United States, I ask the privilege of enrollment as a Charter Member in the National Amateur Wireless Association and request that you send me the Charter Members' Equipment for which I enclose herewith remittance of $2.50.* (Option.)

I trust that you will act upon my application promptly and forward the equipment to me at the earliest possible date.

My qualifications for membership are given in blank spaces below.

Signature ..... .....Age.....

Street Address .....

Town and State.....

**Please credit me with $..... paid for.....**

* Option.

**In the event that an applicant is unable to send the entire amount of the membership dues with this application, the figure $2.50 may be crossed out and $1.00 written in its place. This will be considered an agreement on the part of the applicant accepted for Membership that the balance of dues ($1.50) will be paid at the rate of 50c per month for the next three months, at which time pin, pennant and Certificate of Membership will be issued. The other equipment will be sent at once.**

## FILL IN ANSWERS TO THESE QUESTIONS.

1—Have you a Government License (give number.....) or do you purpose applying for one?.....

2—If you are under 21 years of age, give names of two adults for references as to character.

Reference.....

Reference.....

3—If you are a member of any Local, State or Interstate wireless club or association, give its name, and name of Secretary with address.

.....

4—Are you now a subscriber to THE WIRELESS AGE?.....

5—If you already have any books included in the equipment, state which ones.....

.....

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# National Amateur Wireless Association

A DIRECTING ORGANIZATION DEDICATED TO THE PROMOTION OF RADIO COMMUNICATION

CALL LETTERS 9PY
S. W. PIERSON
CARROLLTON, ILLINOIS

GUGLIELMO MARCONI, PRESIDENT

Reduced fac-simile of letter head.

## For Clubs and Members of National Amateur Wireless Association

The following list of items of optional equipment is listed at cost price in order to give members and clubs of the Association every material advantage in the way of a complete equipment that may be desired. Prices include transportation charges.

**LETTER HEADS AND ENVELOPES:**

100 National Association Letter heads with imprint of member at left hand side, as illustrated above 75c
Without member's imprint..... 35c
100 Envelopes with imprint..... 65c
*Special prices on 1000 Letter Heads to Clubs.*

**MESSAGE BLANKS:**

Pads of 50..... 10c

**STATION LOG BOOK:**

A record book in which to keep track of all your operations and communications, in paper..... 15c
in cloth ..... 30c

**RADIO STATIONS OF THE U. S.:**

Call list issued by the U. S. Department of Commerce, postpaid.. 18c

**PHOTOGRAPHS AND PICTURES:**

Photographs of important stations, such as Belmar, Arlington, Sayville, Honolulu, etc., 9" x 12", each ..... $1.00

Duotone picture of G. Marconi, with facsimile signature, suitable for framing ..... 25c

**SOLID GOLD BUTTONS,** 14 Karat N. A. W. A. emblem..... $1.75

**WIRELESS MAP OF THE WORLD** in colors ..... 50c

**YEAR BOOK OF WIRELESS TELEGRAPHY AND TELEPHONY,** published at $1.50, special to members and clubs ..... $1.10

**CLUB PENNANTS:** Made of first quality wool bunting, letters and emblem sewed on with cut outs in color and name of club added, prices on application.

Fac-simile of 36 inch Pennant.

Send all orders to
Clayton E. Clayton,
Managing Secretary, National Amateur Wireless Association, 450 Fourth Ave., N. Y. City.



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# THE WIRELESS AGE

Owing to the fact that certain statements and expressions of opinion from correspondents and others appearing in these columns from time to time may be found to be the subject of controversy in scientific circles and in the courts, either now or in the future, and to sometimes involve questions of priority of invention and the comparative merits of apparatus employed in wireless signaling, the owners and publishers of this magazine positively and emphatically disclaim any privity or responsibility for any statements of opinion or partisan expressions if such should at any time appear herein.

APRIL, 1916

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# The American Marconi Company's Annual Report

THE annual report of the directors of the Marconi Wireless Telegraph Company of America and the statement of accounts for the year ended December 31, 1915, were made public on March 27. The report says that the directors feel that substantial improvement has been made in the operation of the company's affairs notwithstanding the fact that progress has been hampered by the restriction of ocean travel and the postponement of the Marconi trans-Atlantic service owing to the European war, and that the year reflects the beneficial results of careful organization of executive and administrative forces. . Several pages of the report are devoted to proposals for government ownership and operation of wireless stations and it is declared that "From every possible point of view there is not a valid reason for placing the government in the commercial radio business. There are controlling reasons of every character why this should not be done."

The operations for the past fiscal year show, before allowing the reserves, a net income of $288,904.66, as compared with $271,888.71 for the year 1914. The management of the company has affected a substantial reduction in expenses, totaling $111,054.55 compared with the previous year.

The income derived from investment of surplus funds amounted to $87,010.01 and adding $17,922.96 interest on stock subscription, the total income from these sources for the year was $104,932.97, as against $150,274.21 for the previous year. The reduction is explained by the liquidation of investments necessitated by capital expenditures. The reserves set aside out of the 1915 profits for the depreciation account have been determined on practically the same basis as in 1914. After setting aside all reserves, the net profits for the year amounted to $177,316.51, or an increase of 18.30 per cent. over the profits for the previous year. This amount has been added to the surplus, increasing that account to $541,887.52 at December 31, 1915, and the reserve set aside at that date against depreciation amounts to $373,415.34.

"The new policies of standardizing wireless equipment and contracting for its use on a basis which provides a fair return for the service rendered," says the report to stockholders, "are now well established with ship owners, and have found favor with newcomers into the mercantile marine field. Important economies in operation have been effected and have resulted in a substantial saving. . . . Although the efforts of your officers during the past year have been largely directed to conservation and perfection of organization on account of the indefinite suspension of trans-Atlantic activities, your company has extended its service materially and greatly raised the standard of its mechanical and electrical equipment, thereby laying the foundation for further extension of operations with the return of normal conditions.

"In view of the great interest in national preparedness, active co-operation with the Government has already been given by distributing among your company's operators blanks furnished by the Navy Department, by which these skilled Marconi men have been enabled to signify their willingness to serve the country in times of emergency. Many have already been enrolled on the official lists as available for war time service if needed.

"With wireless communication featured prominently in the official measures taken for the safeguarding of the country, it is reassuring to know that



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your company, representing practically the entire American field of commercial wireless telegraphy, is managed by Americans and conducts its operations under the direct supervision of the United States Government. Any suggestion that its control is in the hands of foreign interests through capital investment is directly refuted by a very recent analysis of its list of stockholders, numbering 23,027, of whom 21,664 are residents of the United States."

The traffic department reported that notwithstanding that practically all passenger traffic to and from European countries has been suspended, and American shipping has been withdrawn from the Pacific, "it is gratifying to report that due to excellent coastwise service, the receipts from message traffic during 1915 were only about 8 per cent. less than for 1914."

The service which the Marconi system rendered in marine disasters and its usefulness in the tornado which swept southwest Texas in August, 1915, are interestingly reviewed.

It is pointed out that there has been no change in the commercial status of the trans-Atlantic stations, the high power equipments remaining closed to business on account of the war.

"Reliable and rapid service has been maintained between your company's stations in California and Hawaii, and the volume of traffic shows steady improvement," it is declared. "The Hawaiian stations are known as two-way stations, being constructed so as to work with California and Japan simultaneously. The Japanese Government recently notified your company that its new wireless stations at Funabashi and Otchisi near Tokio, are complete and tests are now being made daily with a view to early inauguration of a public service, spanning 5,600 miles of the Pacific. Negotiations on traffic regulations are now in progress with the Japanese Government Department of Communications, and it is expected that by means of the Japanese Government cables the service will be extended, to China, Manchuria and other Far Eastern countries.

"The new circuit connecting the United States with Alaska was opened in August, 1915. . . . Although operated in competition with the submarine cable, the wireless traffic has shown steady increase each month, and has given practically continuous service, whereas the cable is operated but six hours daily. Many times since the opening the cable service has been interrupted, and your company's system has furnished the only means of communication with the territory. A reduction of some 20-25 per cent. in rates, and the establishment of three classes of dependable service, has been the means of making the Marconi service exceedingly popular. . . ."

In that section of the report devoted to the engineering department attention is called to the fact that "the year brought about several interesting developments in the art of wireless telephone communication, and pending the decision of your research engineers as to the relative merits of these developments your Directors have thought it advisable to delay the commercial introduction of wireless telephone."

The use of the Marconi wireless system on railroads has been advanced materially. Many important railroads are considering the advisability of adopting the system.

It is stated that the engineers "have given special attention to the design of suitable wireless equipment for aeroplanes and are confident that highly efficient apparatus for communication from aircraft will soon be developed. The United States Government, and also foreign Governments have expressed the keenest interest in such apparatus."

In a brief review of the work of the legal department it is stated that the injunction issued in the suit by the company against the Atlantic Communication Company (the Telefunken system of Germany) has been modified to permit an increase of power in the Sayville station, and a bond filed to protect the interest of your company.

*(Continued on page 500)*

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# With the Signal Corps Service at the Front

By A British Army Officer

**Editor's Note.—Like a peep behind the scenes of the European theatre of war is this story of wireless at the front, written by an eminent British army officer. With terse simplicity he has told what he saw of wireless on the firing line—told it so vividly that the reader, even as the author has done, will without difficulty be able to visualize a day spent with one of the wireless details of the Allies. ". . . the long Belgian road, the balloon high in the air, the crackle and sparks from the improvised table in the car and the tense faces and attitudes of the men who received the messages from those far above us who were seeing what we all hoped to view later—the trenches of the enemy"—in this way does the writer, who has been twenty months in the thick of the fighting, picture his visit to the radio corps. His remarks on preparedness are significant. "I got to know something of the service rendered by the wireless men," he says, "and the need for proper training ahead of the time when those services will be of the utmost value." The writer of this article is the author of "How Wireless Is Being Used in the War," which was published in the March issue of The Wireless Age. Circumstances born of the war require that his identity be kept secret.**

WHEN I first saw Private Tommy Evans he was crawling along a very muddy ditch at the side of the highroad which leads from Ypres to Popperinghe. Just as my car came alongside him he yelled an inquiry as to whether there was anybody in the machine who could fix up his hand. He evidently saw the big red cross on the side of the automobile.

Tommy had torn his hand pretty badly with a piece of barbed wire and his first-aid package had already been used. After dressing his hand I asked him what he was doing. From the blue and white brassard on his left arm I knew he was attached to the signal division of the Engineers.

"Just tryin' to couple up these wires, sir," he answered, pointing to a number of telephone lines running along the ditch. "The shells have knocked out the line along here and the forward posts need communications."

A couple of days later I met Tommy again, when he came into one of the dressing stations to "borrow" a cigarette. I was sufficiently interested to question him regarding his former life and why he had taken up the branch of the service he was now in, and as his case is somewhat of a lesson and a very good example of the need for training young men along proper lines it may be of interest to the readers of THE WIRELESS AGE.

Evans was the typical product of the English Board School. He had received a smattering of the "Three R's and with them a mass of partly digested ideas of various sciences. As he had to leave his school at the age of fourteen in order to assist in keeping together the souls and bodies of his mother and eight brothers and sisters, he went no further than the law demanded as regards education. One special course—imparted by a very bored teacher for the space of one hour a week—had impressed Tommy greatly. It was designated "Elementary Electricity" and to that sixty minutes a week Tommy Evans looked forward with intense fervor.

If, as it happened in the story books, a kindhearted millionaire had met Tommy just then, the latter would have been taken from his surroundings and would, in a very few years, have attained high rank as an electrical expert. How-


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ever, as this was in real life nothing of the kind happened. I am aware of the fact that there are educational institutions which would have granted Tommy much technical instruction but—in the first place he knew little or nothing of them or how to enter such places and, which was of some importance, working from six o'clock in the morning until six at night in a wholesale shop checking parcels is rather tiring work and leaves small margin for study.

On the other hand, if by education in school and proper suggestion through his daily paper, he had been made to realize that he could master the study he had learned in such a short time to like, Tommy Evans, when his country needed his services, would have been a trained man and not merely an enthusiastic amateur.

This is about the way he described his ambitions and disappointments to me:

"You see, sir, when this 'ere wireless business began to be somethin', I wanted to take it up. I was always balmy about electricity anyhow. But I had to work and I thought the night schools were only for the toffs. It's only since I joined on that I heard that I could have joined the Territorials and got what I wanted. Seems to me that I lost a lot by not knowing just what a chance I had. I got some books from the library and they helped, but I wish I'd known I could have learned this work long ago."

I am glad to say that Tommy's ambitions are now realized; that by the use of a little influence he was enabled to join the wireless branch. He is now a first-class man and many times I have seen him proudly displaying his sergeant's stripes and dashing along the Belgium roads in one of the automobiles detailed to the wireless service.

It was by keeping track of Evans and watching him at work that I got to know something of the service rendered by the wireless men and—*the need for proper training ahead of the time when those services will be of the utmost value.*

*Somewhere in Flanders,*
*Feb. 14, 1916.*

*My Dear Mr. White:*

*Replying to your request for a few words on the wireless situation at the front I beg to send you herewith a short article descriptive of what I have observed. You are at liberty to use whatever portion of it you may find of value.*

*As you will see, I am not able to write technically on the subject, but I have done my best to make it interesting. The little I know of what is being done in the line of improvements I cannot, of course, mention, but I am sure you will be greatly astonished and pleased to learn, in time, how much has been accomplished.*

*If anything I have written helps to make the young men of the United States realize the imperative necessity for proper training in advance of actual work in the field I shall feel that my labor has been well repaid.*

*Very sincerely,*

.....

*Major, H. B. M., Ex. F.*

*The letter to the editor which accompanied this article, written from the first line of trenches*

Thus it happened that I spent a day with one of the wireless details. It was shortly after the first big gas attack of last April (1915). In a clump of trees on the narrow muddy road from Poperinghe to Woesten I found the detail in charge of the wireless work and received a cordial invitation to accompany the men and watch them at work.

First of all, there was the balloon to send up, from which, five miles away the observers would be enabled to see the dim outlines of the German trenches and—possibly—catch the flash of the guns bombarding our lines. The balloon, looking like nothing so much as a greatly magnified banana, was dragged out into the field and the observer and wireless operator climbed into the basket hanging beneath it. Up and up it went until it reached the desired height—about 1,500

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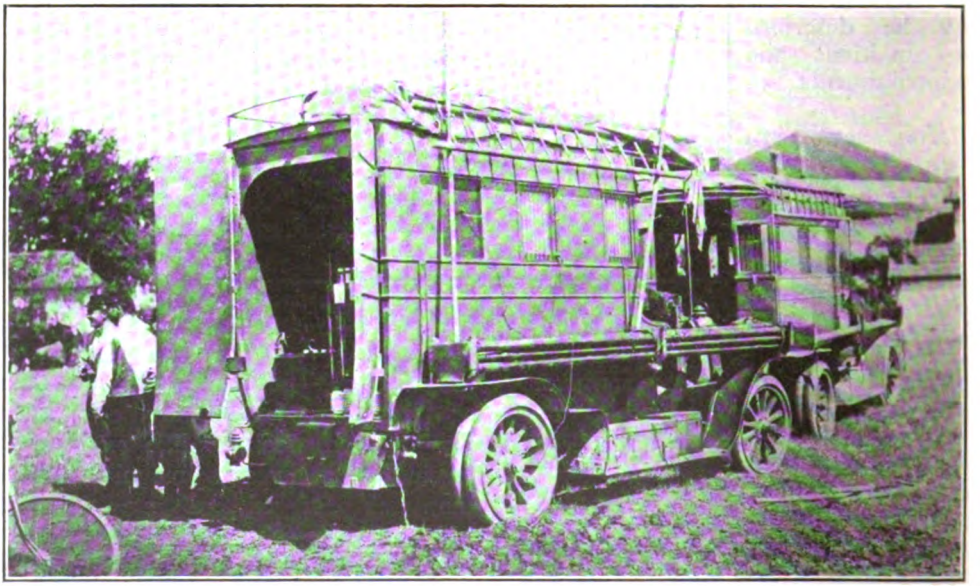
*British signal corps troops in the field establishing communication lines from the military base to the trenches*

yards—and then it slowly drifted towards the enemy's lines, tugging at the cable which held it to the motor lorry beneath.

In the wireless car (once a fine high-class limousine but now changed over to such an extent that its former owner would never recognize it), were a radio



*French field wireless tractors used effectively as "mother stations" to communicate with the light portable sets*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operator and an officer. The operator received the messages as they were flashed from the sky, wrote them out and handed them to the officer.

On our thoughts of what was occurring a few miles ahead in the trenches, broke in the breathless voice of a motor-cycle orderly.

"Beg pardon, sir," he said, addressing the wireless officer. I've got to get a message to Colonel So-and-so, the Blankshires. My bally machine's broke. Can

*A British supply train running under orders transmitted by wireless from portable stations established along the route*

I get over your telephone to him?"

Unfortunately, there was no way of reaching the Colonel by telephone—but wireless came to the rescue. The message was sent through the air to the balloon operator who soon picked out the Blankshires' headquarters. By heliograph the message was sent in code and acknowledged—and another triumph was scored for wireless.

Later in the day we had another example of the value of the art. Again a motor-cycle orderly arrived, uttering curses loud and full of feeling regarding the Belgian mud which had caused his machine to skid with the result that it was thrown into a ditch and wrecked. The bearer of orders for more ammunition for Number Ten battery, he was on even more important service than the first orderly. The wires connecting the battery and the ammunition base were down all along the roads, but at headquarters, near the base, was a wireless station, and in a few minutes the needs of Number Ten were made known and attended to quicker than they would have been had the orderly's machine not gone out of commission.

Notwithstanding all the wonders of wireless which have come to my notice I have never lost the sense of awe due to the realization that from the air, messages are being picked up and sent and that information of priceless value, which could not be transmitted by any other medium, is being received. And hereafter when I step into a wireless room on a

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*British motor supply train en route to the base of operations, accompanied by a motor-cycle messenger to deliver orders from communication points to the officer in charge*

ship or into a receiving station on land, there will be instinctively added to this feeling the visualization of the long Belgian road, the balloon high in the air, the crackle and sparks from the instrument on the improvised table in the car and the tense faces and attitudes of the men who received the messages from those far above us who were seeing what we all hoped to view later—the trenches of the enemy.

Later that evening, after the balloon had descended and the night men had erected their masts and stood ready to receive and send messages to and from headquarters and observation posts in the trenches, I sat for a time with Tommy Evans, (now Sergeant Evans) discussing the day's work. I discovered then, to my great surprise, that most of the men had begun wireless work since they enlisted, and that, while all had been more or less interested in it, they had not taken it seriously until the necessity arose.

Among all those who have performed such excellent services for their country during this war none has excelled the men of the Signal Divisions. And this is particularly true of the members of the wireless branch. Of all nations England has paid least attention to the training of her young men in the radio art and it was only when the war broke out that the Government recognized the value of the enthusiastic amateurs who had "disfigured" the landscape by placing an-

*Mounted orderlies whose duties and experiences in signal corps work are vividly described in this article*


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tennae on their houses and disturbed the nights with the crackle and spark of their instruments.

Every one interested in the radio art realizes that the European war has demonstrated the value of wireless telegraphy to no inconsiderable degree. After the history of this conflict has been written I am sure that due praise and honor will be given to the men of the service who have done so much in the face of big obstacles to make competent the wireless corps of the entente nations; for to train young men along serviceable military lines when their only asset was unbounded enthusiasm, has been far from an easy task. Nevertheless, this was done and to-day there is no more efficient force of wireless men than that of the Allies.. It must not be forgotten, however, that to obtain this result required a good deal of training after the war began and that much valuable time was lost, because of the fact that enthusiasm and loyalty, no matter how great, will never offset lack of knowledge.

On my last visit to England from the front I was so impressed by the usefulness of wireless that I induced two of my relatives who had declared their intention of enlisting to enter that branch of the service. One is now at the front and the other is taking instruction in wireless and aviation, for the purpose of using the two in combination.

The British Government, which controls the entire telegraph and telephone service of the United Kingdom, has ordered that every telegraph operator be given a course in wireless work. For this purpose thousands of text-books have been ordered and promotion will depend greatly upon a man's progress in this art. This, at least, serves to demonstrate that the British Government has learned to value wireless and sees the necessity for training men to be skilled in the art.

*The British field wire telephone in operation under the direction of the signal corps*

As fast as the radio education of these men is completed and they can be spared from the duties awaiting them in England, they will be detailed to army service at the front. The employment of mobile wireless stations with the supply columns is now being developed, but full information regarding what is being accomplished along this line cannot be made public now. However, at a future

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date I may be able to give interesting details concerning this work and an explanation of how it is done.

I wish I could be in this country when Marconi returns to the United States and relates what he has accomplished at the front. He will give you the technical details of which I, unfortunately, am ignorant, and I am sure he also will be able to impress strongly upon you the necessity for a competent and thoroughly trained body of men, which will be ready and available at any time to handle the wireless work of the army.

How the art is used on the firing lines cannot, of course, be told of in detail as yet. When the war is over, however, if not before, the facts will be made public.

Just as it takes a crisis to develop a man, so it has taken this war to develop wireless telegraphy to a point which two years ago was undreamed of. And not the least of the many lessons learned in the war is that which has taught us that a well trained and competent body of wireless operators and signal men is one of the greatest assets an army can possess.

## CHANGES IN CENSORSHIP REGULATIONS

Changes in the naval wireless censorship regulations have been announced by Secretary Daniels. A strict interpretation of the regulations as they were made when the Government placed naval censors at Sayville and Tuckerton prohibited the censors from passing for publication in the United States the German official statements if they made reference "to movements or locations of war or other vessels of belligerents." This operated to prevent Germanys statement of the result of naval operations being received direct from Germany, although they were received by cable via London after having passed through the British censorship.

The regulations as now modified by Secretary Daniels provide: "The restriction as to movements of war or other vessels of belligerents shall not apply to messages received from belligerent shore radio stations. It applies only to Germany, as Great Britain is using the cable."

## PRAISES THE ANCONA'S OPERATORS

Pietro Buffa and Nicola de Crecchio, Marconi operators on the steamship Ancona, which was recently torpedoed in the Mediterranean Sea, have received favorable mention from the Italian Ministry of the Navy as a result of their bravery in time of stress. A letter from the under-secretary of state for the navy follows:

"The Committee who had charge of investigating the circumstances attending the sinking of the s. s. Ancona have felt it their duty to make special mention of the efficacious and commendable work done by the two Marconi operators, Mr. Pietro Buffa and Mr. Nicola de Crecchio, by making timely important communications to the captain of the ship, by the rapidity wherewith they sent wireless signals of danger and help so as to enable the French steamer Pluton to arrive at the scene of disaster only five hours after the sinking of the ship; and also because, not being in a position to continue their work on account of the wireless station being destroyed, they saved themselves only on the last lifeboat that left the ship.

"I am well pleased to bring to your notice the two operators, who in this disaster gave proof of serene energy and a high sense of duty.

"I therefore consider that they deserve special praise, which you will please give them in my name."

In order to observe strict neutrality during the European war the Columbian Government has suspended the operations of two wireless stations on the coast of that country.

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# How Wireless Has Served the Sea

## Sixteen Years of Triumphant Achievements of an Unerring System and a Brave Devotion to Duty

### PART ONE

A REMARKABLE record of achievement is presented by wireless telegraphy since the service was first utilized in controlling the forces of nature for the benefit of mankind. It shows what the aerial message has done to safeguard lives on board vessels disabled by storm or mishap; that come into collision in the ocean fog; that are wrecked on rocks or swept ashore. It shows how fire in midocean has been robbed of much of its historic dread and how rescue is brought to the helpless victims of warfare on merchant ships.

In no single instance on record has the Marconi system failed of its purpose, and even where sea or storm or fire or collision have temporarily disabled the apparatus, it has been quickly set aright and its intended work fulfilled.

All through this serial story of the sea's happenings runs the record of men living up to the traditions of the Marconi service. The list of such men who bravely gave up their lives to duty tells a story of courage amid difficulty and danger, of men who braved death to save the lives of others, men who were the last to leave the sinking ship.

The first recorded use of the wireless in rendering assistance to a ship endangered by collision, was on March 3, 1899, when the steamship R. F. Matthews ran into the East Goodwin Lightship. This accident was reported by wireless telegraphy to the South Foreland Lighthouse, and lifeboats were promptly sent to the relief of the lightship. It was an incident of small importance in itself, yet a harbinger of great deeds to come.

Years passed, and then suddenly occurred one of the greatest shipwrecks of modern times—one, indeed, in which the Marconi wireless service first impressed its overwhelming importance upon the public mind, through being the means of saving nearly 1,500 lives. With thirty feet of her bow cut away, the Italian steamship Florida, of the Lloyd Italiano Line, came slowly into the port of New York on January 25, 1909. Three days before, near Nantucket, she had run down and sunk the White Star liner Republic. The Baltic, also of the White Star Line, brought the survivors of both steamships into port. Thanks to the utility of the ether-waved call for aid, it was a story of lives saved rather than of lives lost.

The collision occurred in a dense fog shortly before six o'clock in the morning, while both vessels were out of their courses. While the passengers were huddled on the deck of the Republic, water pouring into a rent in her port side, one whose task was all-important was John W. (Jack) Binns, Marconi operator, to whom the survivors owed the swift summoning of distant ships, and the world owed what news it received within a few hours of the collision. A few moments after the Florida faded back into the mist whence she had come, the air above the ship was transmitting the code signal C Q D, which apprised the world of what had happened. The Re-



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public's whistle kept going, and this brought the Florida back out of the fog to the aid of the vessel she had wounded. The passengers were then transferred to the Florida.

On board the Republic there remained only the Captain, the second officer, the boat's crew and the Marconi operator. Distant vessels, which had picked up the call for aid, were guided by Binns to the scene of the accident. And the cheering news had gone out to the world that the passengers were safe, the ships had not sunk and that there was no immediate danger. The wireless told its story all the livelong day and well into the night, until the electricity in the storage batteries gave out. The dynamos had gone when the engine room was flooded. But the great Baltic then hove in sight, and the Gresham from Wood's Hole.

The world was forced to marvel at the now historical story told by Captain Ransom, of the Baltic. "We got notice at six o'clock on Saturday morning," said the Captain, "that the Republic had been in collision and needed assistance, and we turned. We went back and commenced the search. It began at eleven o'clock and continued until eight at night. She was found finally by means of wireless. She heard our whistle and steered toward us, guided by wireless. As fast as our Marconi operator got a message, he rushed it to me. I have all the copies. One of them reads: 'You are now on our port bow. Can you see us? Republic.'

"Other messages read: 'You are now very close. Can you see our rockets? Republic. Steer east-southeast. Listen to our bell. Republic.'

*Jack Binns, to whom the survivors of the Republic owe the swift summoning of rescue ships*

"It was a sort of blindman's buff, with the wireless messages coming, 'Now you are hot, and now you are cold.'"

The Republic rescue stands out in the lay mind as the first collision at sea to receive wireless aid.

Only two days previously, on January 20, the steamship Hamilton, of the Old Dominion Line, had been in collision with a car barge of the New York, Philadelphia & Norfolk Railroad, in Hampton Roads. The distress call was sent out by wireless, and soon after tugs were towing the badly battered steamer back to port. Then, on March 10, blanketed by a dense fog and proceeding at half speed, the coastwise steamship of the Maine Steamship Company, the Horatio Hall, Portland for New York, and the H. F. Dimock, of the Metropolitan Line, New York for Boston, met in the middle of the narrow channel known as Pollock Rip Slue, with a crash that sent the Hall to the bottom within half an hour and caused the Dimock to run ashore six hours later on Cape Cod Beach. The two steamships, looming out of the fog, had met in a crushing jar, the sharp, nose of the Dimock going through the side of the Portland boat. The wireless operator on the sinking Hall managed to transmit a brief message calling for aid, and then the passengers on the Hall were dragged to the deck of the Dimock, which began to list. Six hours of silence ensued, during which half a hundred wireless stations, commercial, government and amateur along the coast from Portland to New London, endeavored to obtain news of the accident. Revenue cutters, scouring the waters

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up and down the coast, managed finally to reach the place of the disaster and rescue the men and women on the disabled Dimock.

The wireless next served its purpose in the rescue of endangered passengers on the steamship Ohio, which was rammed and sunk by a craft off the Alaskan coast on August 27. Vessels which responded to her calls for help saved 200 lives.

Lowering fogs, through which the helmsman guides the ship's uncertain way, are the most prolific causes of collisions, as can be seen in this summary of such events. The siren's voice is deadened and the location of the oncoming vessel is rendered uncertain by the ocean haze. It is the wireless only that can bring help to the stricken ships. Such was the case with the steamer Merida, of the Ward Line, which, on May 12, 1911, while off the Virginia Capes in a heavy fog-bank, bound for New York from Vera Cruz and Havana, was struck midships by the Admiral Farragut, on her way from Philadelphia to Jamaica. The wireless distress call was launched, and responded to by the steamship Hamilton, to which vessel all persons on board the two colliding ships were transferred before the Merida sank. The Admiral Farragut was helplessly disabled.

Next occurred the greatest marine disaster in world's history, when the Titanic, the largest passenger liner of her time, on April 15, 1912, came into collision with an iceberg and went to the bottom of the Atlantic, carrying with her nearly 1,400 lives. More than half that number of persons were saved, however, through the steadfast courage and self-sacrifice of the Marconi wireless operators, Phillips, the senior, and Harold Bride, his assistant.

Bride described the scene in the wireless room of the Titanic as follows:

"Phillips and I were in the room. 'Send a call for assistance,' ordered the Captain, barely putting his head in the door.

"'What shall I send?' asked Phillips.

"'The regulation international call for help. Just that,' was the reply.

"Phillips began to read C Q D. 'Send S O S,' I said. 'It's the new call, and it may be your last chance to send it.'

"We picked up first the steamship Frankfurt. The Carpathia answered then, and we told her our position and said we were sinking by the head. Phillips told me the wireless was growing weaker. The Captain came and told us our engine rooms were taking water and that the dynamos might not last much longer. We sent that word to the Carpathia.

"How poor Phillips worked through it I don't know. He was a brave man. We picked up the Olympic and told her we were sinking by the head. As Phillips was sending the message I strapped his life belt to his back. Then came the Captain's voice: 'Men, you have done your full duty. You can do no more. Abandon your cabin. Now it's every man for himself.' Phillips clung on, sending and sending. He clung on for about ten minutes or maybe fifteen minutes after the Captain had released him. Water was then coming into our cabin. Phillips ran aft, and that's the last I ever saw of him alive."

Bride was washed off the foundering vessel, swam to the surface and was pulled aboard a boat and saved. His senior went with the other souls to the bottom.

Another scene of this ocean drama is related by Howard Thomas Cottam, wireless operator aboard the Carpathia, the ship of rescue:

"I got the Titanic C Q D call at 11:20 o'clock on Sunday night. It was this: 'Come at once. We've struck a berg. It's a C Q D call, old man."

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Then the Titanic operator followed with his position, which was latitude 41:46 north and longitude 50:14 west. I think I received the C Q D seven to ten minutes after the Titanic struck. It was only by a streak of luck that I got the message. After hearing the Frankfurt, then I heard the Olympic calling the Titanic with a service message.

*Walter Seddon, first operator on the Volturno*

"All this time we were hearing the Titanic sending her wireless out over the sea in a last call for help. 'We are sinking fast,' was one which I picked up being sent to the Olympic. Just before we reached the Titanic I got this message, and it was the last one I received: 'Come quick, our engine room is flooded up to the boilers.' I answered that our boats were ready, and for them to get theirs ready also, and that we were doing our utmost to get there in time. Until we reached the spot where the Titanic foundered, I was listening for a spark from his emergency set, and when I didn't hear it, I was sure he had gone down."

Owing to its speed and the vast distances it travels, wireless aid is distinguished from all other forms of safeguard at sea by the promptness with which it communicates the story of disaster, and brings rescuers to the stricken ship. It was this feature of prompt service that saved all the lives aboard the steamship Madison, on February 22, 1912, when she was rammed by the Hippolyte Dumois; and resulted in the preservation of the El Sud in April, of that year, when she came into collision with the steamship Denver off Galveston Bar. The El Sud was not equipped with wireless, but, fortunately for her, the Denver was, and in response to calls sent out by the latter, assistance came and the injured steamship was towed into Galveston.

*Christopher Pennington, second operator on the Volturno*

Similar promptitude on the part of Arthur Ridley, of Ridge Hill, Mass., the Marconi operator on the Millinocket, in summoning a tug and a lighter, when that vessel was struck by the steamship Persian on July 24, 1913, resulted in the successful docking of the injured ship. A wireless appeal for assistance brought an equally prompt response to the steamship Pleiades, in October of the same year, when she was struck by an unknown steamship off the Pacific coast. A tugboat appeared in answer to the call and towed the Pleiades to port in safety. There would undoubtedly have been great loss of life in an accident which occurred ninety-five miles south of Hatteras on November 1, had there not been a speedy response to the radio call. The steamship Norwega came into collision with the schooner Glenlui, tearing a hole in her side of such enormous size that she rapidly filled with water. A passenger vessel, two revenue cutters and a battleship were soon at hand and saved all on board.

The fine spirit of devotion that typifies the Marconi service was next exemplified by the heroic conduct of a wireless operator, who sacrificed his life in humanity's cause. It was in a heavy fog off Hog Island, sixty miles from Cape Charles, on the morning of January 30, 1914, that the Old Dominion Line steamship Monroe came into collision with the smaller ship, the Nantucket, of the Merchants' and Miners' Transportation Company. Ferdinand J. Kuehn, chief wireless operator on the Monroe, who was in the operating room when the accident occurred, notified his assistant, R. S. Etheridge, and sent the S O S call. Etheridge fetched two life preservers, and while one was being put on by Kuehn, Etheridge continued sending out the S O S, giving the position of the Monroe which was sinking rapidly.

Etheridge then dashed for a lifeboat and was picked up by the Nantucket. Kuehn was standing on deck when a woman ran toward him. "Where is your life preserver?" he asked. "I have none. Oh, I am lost," she cried. Kuehn took off the one he wore and fastened it upon her. Then he led her to the rail and helped her over. Attempting to enter

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the boat, Kuehn missed his footing and fell into the water. He managed to keep afloat for a while, during which time efforts were made to rescue him, but the water was too cold and he finally sank, after having given up his life to save another. The Monroe sank ten minutes after the collision. Forty-three lives were lost and ninety-eight persons rescued as a result of the help that arrived in answer to the distress call.

Again this lesson of courage and strict attention to duty was heralded to the world, several months later, when two wireless telegraphers on a sinking liner, at the risk of their lives, sped the message of disaster to the nearest shore. The Empress of Ireland, bound for Liverpool, had left Montreal on May 27 in a thick fog. When in the St. Lawrence River, 150 miles from Quebec and ten miles from Rimouski, she came into collision with the Danish collier Storstad, with fifty men aboard, feeling her way through the fog, inward bound. The collier crashed into the liner and tore her side open to the stern. The two Marconi operators on board the Empress were Ronald Ferguson, senior, and Edward Bamford, his assistant. While the vessel began to list, the operators quickly sent out the S O S, reaching the land operator at Father Point. Then the lights went out aboard the Empress, she careened and sank.

Meantime, the operator at Father Point sent word to the Canadian government boats Eureka and Lady Evelyn, which steamed to the scene of the disaster. They found 452 survivors in the lifeboats of the Empress, among whom were the two operators. The death list of the disaster was placed at 1,024, and the prompt work of the Marconi operators undoubtedly served to save those who were rescued from the foundered vessel.

On the morning of August 25, of the same year, the steamship Admiral Sampson, owned by the Pacific Alaska Navigation Company, was feeling her way carefully along her course, off Point-no-Point, near Seattle, Wash. The greater number of the passengers were asleep in their berths, but some of them, aroused by the siren, had come on deck. The Princess Victoria, of the Canadian Pacific Line, was also making her way through the fog in much the same cautious manner as the Sampson. Fog whistles on both vessels sounded continuously, but the thick mist blanketed the warnings. The Victoria rammed the Sampson, a steel vessel, directly on a line with the after hatch, cut three-fourths of the way through her, and opened a twelve-foot gash in her own steel plates, in which the cover of the Sampson's hatch was still jammed when the Canadian Pacific liner arrived in Seattle with the survivors.

The vessels were so close together that the majority of the Sampson's passengers were able to climb on board the Victoria. The bow of the Victoria entered the side of the Sampson at a point where a considerable quantity of fuel oil was stored and crushed several large containers. They were set ablaze, and in an instant both vessels were enveloped in flames. When the Victoria backed away, the Sampson's side was left uncovered and she began to settle and went to the bottom four minutes after she was struck.

W. E. Reker was the senior wireless operator on the Sampson, and while the vessel was foundering, he made his way to the Captain on the bridge, preferring to share whatever fate overtook his commander rather than seek safety by leaving the doomed craft. The two men faced death fearlessly in the line of their respective duties, and were drowned. Not less praiseworthy was the conduct of H. F. Wiehr, the junior Marconi operator. He stayed on the Sampson until the last, finally being compelled to jump over the side, and was picked up by one of the lifeboats.

Meantime the wireless operator on

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the Victoria had sent out the S O S call, which was picked up at the Marconi station at Seattle, and established communication with the steamship Admiral Watson, which came to the aid of the injured vessel.

The steamship Metapan, of the United Fruit Company's Line, on October 15, was rammed in the fog by the freighter Iowan, of the Hawaiian-American Line, at the entrance of Ambrose Channel, New York Harbor, and sank. When the collision occurred the wireless operator on the Metapan sent out a call for assistance, which was responded to by vessels in various parts of the harbor, and all on board were rescued.

*Ferdinand J. Kuehn, wireless operator on the Monroe*

On January 24 of the following year, the Washingtonian, of the Hawaiian-American Line, came into collision with the five-masted schooner Elizabeth Palmer, off Delaware Breakwater. The Washingtonian sank, and the schooner was abandoned with her decks awash, only one life having been lost. Captain E. D. Brodhead, of the Washingtonian, ordered the lifeboats to be made ready, and into them the crew of forty-odd men tumbled. There were also thirteen men and one woman on the schooner. All made their way safely to a lightship, and wireless messages sent from the station there summoned the steamship Hamilton, of the Old Dominion Line, which stopped and took aboard the victims of the wrecks, and conveyed them to New York.

But it is not only in the solitude of midocean or in the perilous channel that the wireless teaches the lesson of its superb value. Its service is as efficient on the lake or the inland water course. This was shown on March 25, 1915, when the steamship Parisian grounded in the Mississippi River. While in this position she was struck two days later by the Heredia, of the United Fruit Company, which had 164 passengers aboard. Wireless brought prompt aid to the two distressed vessels.

On May 26, 1915, the S O S aided in the rescue of 230 passengers who were aboard the Holland-American liner Ryndam, which was in collision with the fruit steamer Joseph J. Cuneo, south of the Nantucket Shoals. Water poured in torrents into the hole which the Cuneo tore in the side of the Ryndam, and the bows of the fruit steamer were stove in, she also taking water rapidly. On board the Ryndam were two Marconi operators, B. Moore, senior, and A. T. A. Le Clercq, his assistant. They sent out the distress signal while the passengers were being transferred to the Cuneo, which was the least damaged of the two vessels. The battleships South Carolina, Texas, Louisiana and Michigan responded to the call, and the South Carolina took aboard the passengers who had sought safety on the fruit steamer. No lives were lost.

Even in casualties at sea, where the wireless is not the direct means of saving life, or ship or cargo, the mere fact that the service is at hand, ready for immediate use, brings solace and hope to those endangered. This is made evident in the following list of accidents: On June 13 of the same year there was a collision between the Metropolitan Line steamship Bunker Hill, bound from New York to Boston, with 250 passengers, and the steam yacht of C. K. G. Billings, the Vanadis, in a fog off Eaton's Neck, L. I. Two persons were killed and several injured as a result of the accident. Ingalls and Pitts, Marconi operators on the Bunker Hill, sent Marconigrams to New York, giving news of the accident. The Bunker Hill returned under her own steam, and several vessels which had received the wireless message volunteered their aid, which, however, was not needed.

*Raphael Emanuel, the Templemore's operator*

The pilot boat New Jersey was rammed and sunk by the United Fruit steamer Marchioneal at the eastern entrance to Ambrose Channel on July 10, 1915. The crew was saved by the Marchioneal, and S O S calls brought assistance, which, again, was not needed.

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The presence of wireless apparatus lent courage and steadiness to those aboard the steamship Dorchester, when, on May 28, she was rammed by the schooner J. A. Palmer, off Annapolis, Md., and the aerial message was utilized to apprise the world that no lives had been lost. And when, on June 16, the steamship Alabama was struck by the Delaware, fifty-three miles south of Scotland Lightship in a dense fog, and neither vessel suffered serious damage, wireless was used to relieve the anxiety of the owners. Also on February 1, 1916, when the Takata Maru came into collision with the Silver Shell, the fact that the last-named vessel had rescued the former's crew was sent by wireless to the Marconi stations at Boston and Cape Race.

There is probably no danger that is dreaded more by the seaman or the sea traveler, than the ship afire. Storms may be outlived, and the ship with broken propeller blades may drift, but flight, as a rule, is the only salvation from the burning ship. But the aerial message brings aid so swiftly to those marooned on flaming vessels of late years that the dread of this form of calamity has been materially lessened.

Plying between Panama and Peruvian ports, the steamer Huallaga, of the Peruvian Dock & Steamship Company, took fire at sea on July 20, 1910, off the north coast of Peru. In fighting the flames, three of her seamen perished. Wireless operators flashed the S O S which was received by the steamship Ucayali. Making all haste, the rescuing vessel arrived in time to take off all the passengers and the remainder of the crew. Three days later, July 23, the Momus, of the Southern Pacific Company, bound from New York to New Orleans, took fire south of Cape Hatteras. Under the directions of Captain Boyd, the crew fought the flames for hours, but the fight becoming hopeless, the Captain summoned aid by means of the wireless. The steamship Comus responded to the call, not only taking off the passengers safely, but assisting in subduing the flames. The cargo and vessel, valued at $3,000,000, were saved. Again, on January 25, 1911, the Queen, of the Pacific Coast Steamship Company, while off Point Reyes, Cal., developed fire in her forward hold. The distress call brought four steamers to her assistance and the crew and eighty-seven passengers were saved.

The year 1913 was one in which there occurred an unusual number of fires at sea. Never before did the Marconi wireless service have a better opportunity to prove its utility. On June 10 of that year, the Olinda, of the Munson Line, with five passengers aboard, caught fire at sea. In response to the S O S call, the U. S. S. Nashville went to her assistance and took off the passengers in safety. Fire started on the British steamship Templemore on September 29 while she was on a voyage from Baltimore to Liverpool. Raphael Emanuel, the Marconi operator on board, sent out the distress signal, which was picked up by the steamship Arcadia, fifty miles away. While the Arcadia was hurrying to the burning ship's relief, the Templemore was consumed by the flames, 800 miles east of the Virginia Capes. Passengers and crew were in the lifeboats when the rescuer arrived and took them aboard. During October the steamship Berkshire was burned off Lookout Cove, N. C. The S O S call was heard at Wilmington, 164 miles away, by the revenue cutter Seminole, which reached the scene of disaster in time to take off all the passengers. After the flames were extinguished the following day the vessel was towed to a safe anchorage.

Of all the marine disasters of that fateful year, the most sensational was the burning of the immigrant ship Volturno, which was ablaze from stem to stern in a terrific storm in the Atlantic, 450 miles east of Newfoundland, on Thursday, October 9. Wireless calls fleeting over the ocean, brought ten vessels to the rescue, but for more than twenty-four hours they were compelled to cruise about the flaming vessel, incapable of rendering help because of the fierce wind and turbulent sea. It was not until the next morn-

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ing that it was found possible to transfer passengers. Of the persons aboard, 521 were rescued. The others, numbering 136 souls, lost their lives in the raging seas, which smashed the lifeboats against the sides of the Volturno and spilled their human freight into the water.

The Marconi wireless operators on the Volturno were Walter Seddon and Christopher Pennington. Pennington performed his duties courageously while menaced by peril and escaped from the vessel by leaping into the sea. Seddon was an occupant of the last boat that left the doomed craft.

With seas running so high that it was seemingly impossible for small craft to live in the waves, 103 passengers of the Spanish steamer Balmes, which was threatened with destruction by flames, were taken from the burning vessel by the Pannonia, of the Cunard Line, on November 14, after aid had been summoned by the Marconi wireless. The rescue occurred 600 miles east of Bermuda. While Captain Ruiz, of the Balmes, and his men battled with the flames, Inocencio V. Michavila, senior Marconi operator, began sending the S O S. The Pannonia was 287 miles distant from the burning ship when the call of distress was received by the senior Marconi operator, Stanley G. Rattee. His assistant, Edward Murphy, who was in the ship's hospital, crawled from his berth to the wireless room to aid his comrade in gaining the location of the distressed vessel. The Pannonia rescued 125 persons from the burning ship. At the time of the rescue the crew of the Balmes was reduced to the last degree of exhaustion, and the firemen lay about the deck so overcome, as a result of asphyxiation, that they had to be relieved every fifteen minutes.

The freighter Columbian, bound from Antwerp to New York, caught fire on May 3, 1914, while 300 miles south of Cape Race. The members of the crew were driven to take refuge in the lifeboats, and fifteen of them perished. Thirteen of the survivors were picked up by the steamship Franconia, of the Cunard Line, fifty hours after the men aboard the ship had been driven to the boats by a serious explosion of unknown origin. Among those taken on board the Franconia was James Drohan, the Marconi operator on the Columbian. This rescue was made possible by the receipt by wireless of news of the disaster by the Franconia's Captain from other ships that had passed the burning Columbian after she had been deserted by her men. The Cunarder searched for the boats of the survivors and picked up the one containing the thirteen men. The Cunarder, by wireless, then cautioned other vessels to be on the lookout for the missing boats of the Columbian, which resulted in the rescue of the remaining survivors by the Manhattan and the Seneca. In all thirty-one lives were saved.

On September 1, while the City of Chicago, twelve miles out from Chicago, was learned to be on fire, apprehensions regarding the safety of those aboard were quieted by the comforting assurance, transmitted by wireless, that the vessel was in no danger, and in time she returned safely to port.

Another spectacular marine disaster, which caused much anxiety to the friends and relatives of those aboard the vessel, was the fire of mysterious origin on the French liner La Touraine, bound from New York to Havre, with a cargo of ammunition. An S O S call sent out by the liner on March 6, 1915, apprised the world that a serious fire had developed on board and that the flames were spreading at an alarming rate. The call was promptly answered by the steamships Arabic, Cornishman, Swanmore and Rotterdam. The Rotterdam was the first to arrive, and announced her readiness to take off the passengers, but by that time the crew had made headway against the flames. The Rotterdam, however, remained nearby, ready to lend aid, and escorted La Touraine as far as Prawle Point, where two French cruisers came in sight and convoyed the injured vessel to Cherbourg.

This year also was one prolific of fires. In the month of May two ves-

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sels were saved from destruction by the prompt summoning of aid by wireless. The steamship Standard was at sea in latitude 22:50 north, longitude 88:18 west, on May 18, when fire was discovered in her oil-fuel bunkers. The distress calls brought the steamships Bradford, Winifred and Alfonso to the scene. They fought and extinguished the flames and the Bradford towed the disabled vessel into Key West. On May 28 the steamer Mackinaw was on fire off San Francisco, and wireless calls brought tugs to the assistance of the burning vessel.

Alarm occasioned by a fire on board the steamship Sucha, on July 22, while in the Gulf of St. Lawrence, was emphasized by signals for help sent out from the ship and received by the Royal George. The latter proceeded to the rescue, but received word later that the fire had been controlled and help was no longer needed, which cheering information was promptly sent to shore by wireless.

Nearly 500 persons, abandoning a burning vessel in midocean, were rescued from their distress through the beneficent aid of the Marconi wireless service on September 11, when the Greek liner Athenai, bound from New York to Piraeus, caught fire. The vessel was entirely destroyed. The passengers and crew, numbering 470 souls, crowded in lifeboats, were rescued by the Tuscania and the Roumanian Prince. Two days later the lives of more than 1,700 persons were saved through the summoning of assistance by aerial messages. The Fabre Line steamship Sant' Anna, from New York to Naples, was thronged with 1,700 Italian reservists when she caught fire in midocean. The S O S call brought the Ancona to the scene. She took off 600 persons and convoyed the distressed vessel to port.

On November 1 the steamship Rochambeau sent out wireless calls, stating that she was on fire, which were immediately answered by nearby vessels. The ship, however, sent messages subsequently, stating that the fire was under control and that assistance was not required. In this instance, as in others, failing in the wireless service, the world would have undergone anxious days of waiting before this cheering news could have reached land.

Another instance occurred, where, without the prompt assistance obtained by wireless, a vessel and her cargo would have been a total loss, when, on November 9, the steamship Lievatta, loaded with cased kerosene and gasoline, caught fire sixty-five miles east of Sabine Bar, Texas. The danger was reported by aerial message to the steamship Gulfstream, which arrived and stood by the burning ship until other assistance, summoned by wireless, arrived from Port Arthur and Galveston.

Such is the record to date of the value of the Marconi service in lessening that dreaded danger of navigation, "the ship afire at sea."

The aerial message serves unexpected ends. Many an injured seaman owes his well being, if not his life, to the fact that aid was summoned on his behalf from some doctor or surgeon hundreds of miles distant, when no other help was available.

While the oil steamer Asuncion was off the port of Eureka, Cal., on March 11, 1909, the Humboldt wireless station received from her a message saying that one of the sailors had fallen from the rigging to the deck, sustaining injuries resulting in severe internal hemorrhages. Medical advice was solicited for the injured man. The wireless station at once communicated with the marine physician, Dr. Charles Falk, who prescribed treatment. The vessel remained hove to until the directions of the physician had been received by wireless, when she proceeded on her way, while the remedies presumably were applied.

Captain McGray, of the steamship Herman Frasch, was stricken with ptomaine poisoning and at the point of death, January 2, 1911. A wireless message was promptly sent to physicians of the United States naval station at Dry Tortugas, Florida, about 100 miles away. The operator of the Merida, which was leaving the harbor

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of Progreso, Yucatan, about 800 miles away, caught Captain McGray's message asking for a prescription and method of treatment. The reply, written by the surgeon on the Merida was received on board the Herman Frasch before the naval station at Dry Tortugas could respond. Captain McGray, following directions, prepared a remedy from his medicine chest and soon recovered.

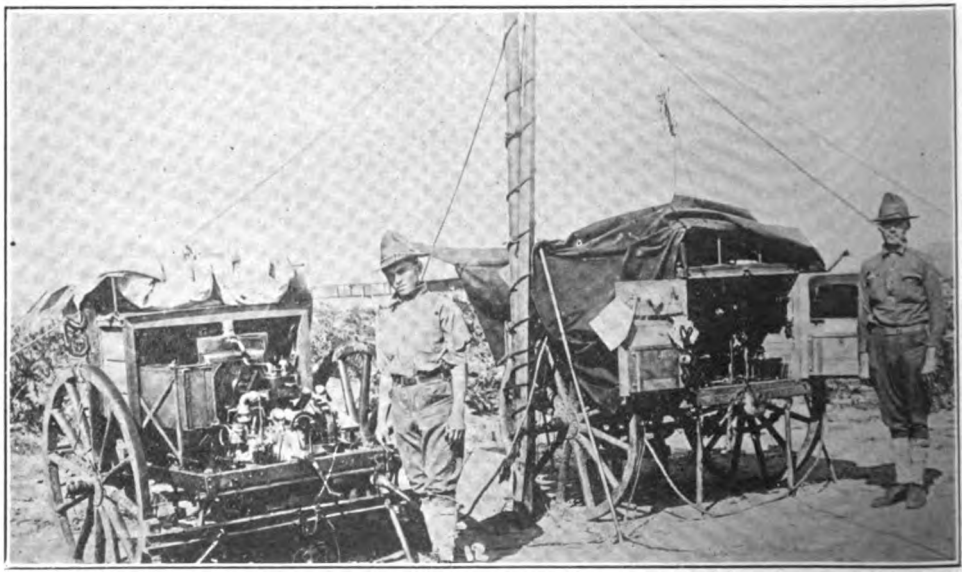
Dr. Ernestus O. Kuhr, of Brooklyn, New York, was aboard the Ward liner Esperanza, in March, 1913, when, on nearing Havana, the vessel's wireless caught a call for medical aid. The call came from the Altastad, a Norwegian freighter. It was explained that William Murray, a Marconi tester aboard, had his arm badly infected. The doctor told him that the case was one for immediate operation, and advised the opening of the arm with a sharp, properly sterilized penknife. He instructed the patient to use carbolic acid freely, and sent detailed instructions for dressing the wound.

A wireless call for a surgeon was sent out by the Marconi operator on the steamship John A. Hooper, in September, 1915. The appeal brought aid to Miss Annie Christiansen, a passenger who, during a severe storm, fell to the floor of her stateroom, sustaining a fractured leg. Aid was rendered by a surgeon on the steamship Allancia, which, although thirty-five miles away, responded to the call. The sufferer received directions by which she could alleviate her distress temporarily. The doctor, however, advised that the patient be sent to the nearest hospital, which was at Kingston, Jamaica, where the young woman was taken.

A wireless call was sent out from the steamship "Radiant," on October 11, 1915, asking for the proper treatment to be extended to the ship's engineer, who, for three days, had remained unresponsive to medicines administered by the captain. The Marconi operator, William C. Thompson, communicated with the station at Tampa, Florida, and then with the Southern Pacific steamship Comus, from which the doctor's advice was obtained, and the sick man was greatly relieved.

These are only a small part of the achievements of the wireless message, which insures comfort and safety to those who go down to the sea in ships.

## USING FIELD SETS IN PURSUIT OF VILLA



*A close view of the wireless equipments employed by United States troops when in the field. The apparatus is of light construction and can be erected and dismantled in a short time. It has great value as means of communication for the United States forces sent on the punitive expedition into Mexico against Villa because of the ease with which the wire telegraph lines can be cut*

# A Dream That Materialized

*(From the Cedar Rapids, Iowa, Gazette)*

ABOUT eight years ago two men visited Cedar Rapids as representatives of a company that was financing a wireless telegraphy project. They explained that a man named Marconi had perfected an invention that was going to revolutionize the telegraphic world and they were traveling in the West for the purpose of selling stock, the proceeds from which were to be used in developing and marketing the Marconi wireless.

Most people were skeptical. The representatives had wireless apparatus with them and they gave demonstrations in the auditorium. Some persons, somewhat less skeptical than the majority, invested a little money in the stock. That was the last they heard of the men who delivered the certificates and took their money. They never received any dividends, and they grinned at one another and decided that they had been victims of a flim-flam.

Recently a Cedar Rapids woman decided to find out whether her stock was valuable or worthless. Marconi has become famous, as has his wireless system of telegraphy. The local woman wrote to the American Marconi representatives in New York. They replied that her name was not on their stock books and that, so far as they could discover, she owned none of their stock. They requested that she send her coupons to them, so that they might learn how the fraud was perpetrated. She complied with their request.

A reply came from New York to the effect that the stock was good, but that it had been issued by the Marconi Company of London, not by the American company. They advised the woman to get in touch with that concern, and she did so. Then she received dividends for the last eight years. There are a few other owners of Marconi stock in this vicinity. They can obtain money in the same way.

Just a few years ago people were calling Marconi a dreamer. They laughed at his plan to transmit messages across miles and miles of sea without the use of wires. But Marconi had courage and convictions—without which, by the way, no man achieves greatly—and he refused to be laughed down. Now he is hailed as a genius, one of the inventors who pave the world's path of progress.

Without its dreamers this old planet would be a poor place in which to live. Contrary to the common belief, it is the dreamers who do. Edison dreamed, and now we can hear Caruso and Melba as they sing from a small, round stage of black glue in the top of a mahogany box. Bell dreamed and we speak across the continent over the telephone. Dreams built the first skyscraper, the first steamship, the first locomotive, the first submarine, the first air ship, the first subway. Dreams have been responsible for most of the world's great achievements.

That is why Cedar Rapids people who once had a small amount of faith in what then was widely thought to be a dream, now can collect dividends on their Marconi wireless stock.

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## THE SILVER SHELL AND TAKATA MARU IN COLLISION

The Shell oil tanker Silver Shell and the new Kippon Line steamship Takata Maru came into collision on the night of February 2, about 200 miles southeast of Cape Race. The crew of the Japanese vessel was transferred to the Silver Shell before the former vessel sank, while the British tramp Armonia and the steamship California, both of which were summoned by wireless, stood by to render aid if necessary.

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The steamship Alamo, 130 miles off Cape Hatteras, sent out a wireless call for aid on March 23, and the coast guard cutter Onondaga went to her assistance.



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# The President's Letter

## What the Communication from Woodrow Wilson to the National Amateur Wireless Association Means to Amateurs and How Their Obligations as Patriotic Americans Can be Fulfilled

**By J. Andrew White**
Acting President, National Amateur Wireless Association

ADDED to the strong endorsements of the National Amateur Wireless Association given by the Secretary of the Navy, the Superintendent of the Naval Radio Service and the Chief Signal Officer of the radio service of the United States Army, the letter from President Wilson, reproduced in this issue, establishes very definitely the standing of the organization with the official nation.

President Wilson's letter is one that must mean a great deal to every member who holds the emblem and certificate of the National Association. "It is only through the agency of such organized bodies that maximum efficiency can be obtained," he says. That means in effect that the development of the amateur to the point of recognition as a factor in the affairs of the country, is due solely and simply to the carefully devised plans for standardized instruction and supervision of activities; it means that the individual amateur who has not availed himself of the co-operation of the Association is still unrecognized as a progressive worker and has no more standing than in the days before the organization came into existence.

The President has paid a sterling tribute to the executive personnel of the Association in stating: "The organization of the amateur radio operators of this country under the direction and control of representative American civil, military and naval officials, would undoubtedly be a valuable asset to the nation." This statement reflects his confidence in the men who direct the Association's affairs, states in so many words that the development of its members and the co-ordinated efforts of its chartered clubs will "undoubtedly be a valuable asset to the nation."

These are very encouraging phrases from a man noted for his conservatism in approving the activities of newly established organizations. Nothing of the kind has ever been given out over the President's signature to movements of similar nature, and this endorsement followed careful investigation into the operations of the body destined to exert a nation-wide influence in the highly specialized field which it represents.

President Wilson has recognized that the auxiliary services which the National Amateur Wireless Association offers to all Americans cannot be duplicated under any existing plan; he has appreciated —to use his own words—that "the value of such an organization in co-ordinating the activities of a large number of specially qualified young men along carefully planned lines will be of great benefit, not only in an educational way to the young men themselves, but also to the country at large when the necessity for their employment, individually or as an organization, may develop."

It is significant that he recognizes N. A. W. A. members as "specially qualified young men." Amateur wireless opera-



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tors developed under the Association's tutelage are thereby set ahead of those conducting their experiments individually under hit-and-miss methods.

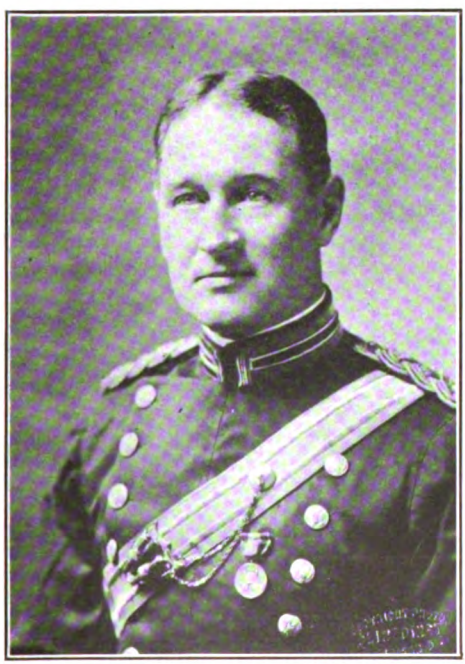
The President's letter should be highly prized by every member and, at the next meeting of the administrative board, as Acting President, I shall propose that a copy of it be placed in the hands of each of the 1300 members.

While on the subject of messages to N. A. W. A. members, I should like to call attention to the letter published in the March issue in which Col. Reber, our vice-president, and the army's chief radio signal officer, mentioned that our operators "will be of great service to the War Department in case of emergency."

There are at present a dozen or more signal corps companies being organized by Association members. The Eastern States are particularly active, but with the single exception of a military signaling organization being created in Texas, the balance of the country is not so well represented in this movement as I should like to see it. It may be, of course, that members and clubs have done organization work of this kind and have failed to advise the Association of their progress. A military committee has been formed at the New York headquarters, and it is suggested that full particulars of all activity of this kind be forwarded for registration. The summer season will soon be upon us, and full data should be in hand early, so arrangements can be made for quarters in the military camps.

Never before in the history of the nation has it been more evident that with efficient communication in time of war, rests the success or failure of campaigns. Since the March issue of THE WIRELESS AGE reached your hands, the American army has entered Mexico in pursuit of the bandit Villa. As I write this short message to members, it is rumored that communication by wire between the border and General Pershing's punitive expedition in Northern Chihuahua has been cut off. It is reported also, that the army's field wireless station at Casas Grandes, is temporarily out of commission. Major Sample, by latest advices, has announced that the field telegraph line, running from Columbus, N. M., to a point thirty miles south of the border, has been cut in twenty-eight places.

What the chase will come to, cannot even be surmised at this time. When this magazine reaches readers the expedition may have finished its work successfully, or any number of complications may have arisen. But aside from predictions which cannot be made, the movement of the troops into Mexico has emphasized what I have said before on the subject of *trained* men.



*Col. Samuel Reber, the U. S. Army's chief radio signal officer and a vice-president of the National Amateur Wireless Association, who has declared that the trained members "will be of great service to the War Department in case of emergency"*

It required one week to get the flying column off, and this is considered unusually rapid work. If, with the men already on the border—men trained for warfare, fully equipped and under experienced commanders—a week was required, how long would it take to send a large army of untrained men into the field if the country is invaded by some first-class power?

This is written on March 22. Excepting four and one-third regiments of

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*The President and his secretary, photographed in the White House. The President's letter, endorsing the National Amateur Wireless Association as an organization of great benefit both to its members and the nation, appears on the opposite page*

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THE WHITE HOUSE
WASHINGTON

The organization of the amateur radio operators of this country under the direction and control of representative American civil, military, and naval officials, would undoubtedly be a valuable asset to the nation, as it is only through the agency of such organized bodies that maximum efficiency can be obtained. The value of such an organization in co-ordinating the activities of a large number of specially qualified young men along carefully planned lines will be of great benefit not only in an educational way to the young men themselves, but also to the country at large when the necessity for their employment, individually or as an organization, may develop.

Woodrow Wilson

*The letter reproduced above was received on March 1 by J. Andrew White, Acting President, National Amateur Wireless Association, accompanied by a note from Joseph P. Tumulty, Secretary to the President, which read: "My dear Mr. White:—I have much pleasure in sending you the enclosed letter which the President has prepared for you." This remarkable testimonial from the nation's Chief Executive emphasizes to members the meaning of the official recognition and approval of the National Amateur Wireless Association given by American Army and Navy officials, firmly establishing the organization as one of national importance*

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infantry, two regiments of cavalry, and what amounts to about a regiment and a half of field artillery, practically all mobile troops of the regular United States Army, either are already on the border territory and in Mexico, or on foreign service. This gives some idea of the defense problem the country faces.

Few Americans realize the extent of the Mexican border line. By railroad, it takes nearly three days from the Gulf to California. And along that line we have something like 20,000 regulars and the number available to reinforce them is about 9,000 more; with the whole force distributed in skirmish formation, about 17 miles could be patrolled. The border line is something like 1,800 miles long.

Consider the Atlantic and Pacific coasts and the Canadian line and you begin to realize how great would be the need of citizen-soldiers if invasion by a first-class power was threatened.

There should be no delay on the part of amateurs. Signal corps troops, sponsored and organized by local clubs, will grow to full strength very quickly. Under command of a competent officer, preliminary drill can begin at once. If organization is made now, the companies and battalions will be aided and assisted

# Letter to National Amateur Wireless Association Showing Preparation of Members for Possible War Mobilization

NAVY DEPARTMENT
U. S. NAVAL RADIO SERVICE
OFFICE OF THE SUPERINTENDENT
RADIO, VA.

*March 15, 1916.*

*I have the pleasure of acknowledging receipt of your letter of March 13, 1916, and today under separate cover the names and addresses of persons who have enrolled in the National Amateur Wireless Association, also a tabulation of the membership by States.*

*The preparation of these data must have entailed considerable clerical work on the part of your office force, and I thank you very sincerely for the information. This will be the greatest help to us in the organization of amateurs along our coast line in times of public peril. For your information, I may state that one district, that of New England, has been thoroughly organized and all are acting in co-operation to produce best desired results. This has been made possible through the activities of our District Radio Superintendent for that locality, and by means of the names and addresses which you so kindly furnished, this office will be in a position to continue the organization further down along the coast, and we are confident that we will get most excellent results as the result of your hearty co-operation in this matter.*

*With renewed thanks and best wishes,*

*Very truly yours,*

W. H. BULLARD,
*Captain, U. S. Navy,*
*Superintendent of Radio Service.*

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by the Association's headquarters military committee under plans which are now being shaped up.

Aside from the obvious fact that it is every patriotic American's duty to prepare himself for emergency, the signal corps work will be found the most fascinating application of wireless knowledge yet devised by the Association's officers. The clubs which have started work along this line are already finding difficulty in taking care of the large number of applicants.

The United States has awakened, and with that awakening has come definite recognition from the nation's President, that the members of the National Amateur Wireless Association are "specially qualified young men" to prepare for the maintenance of communication in event of war.

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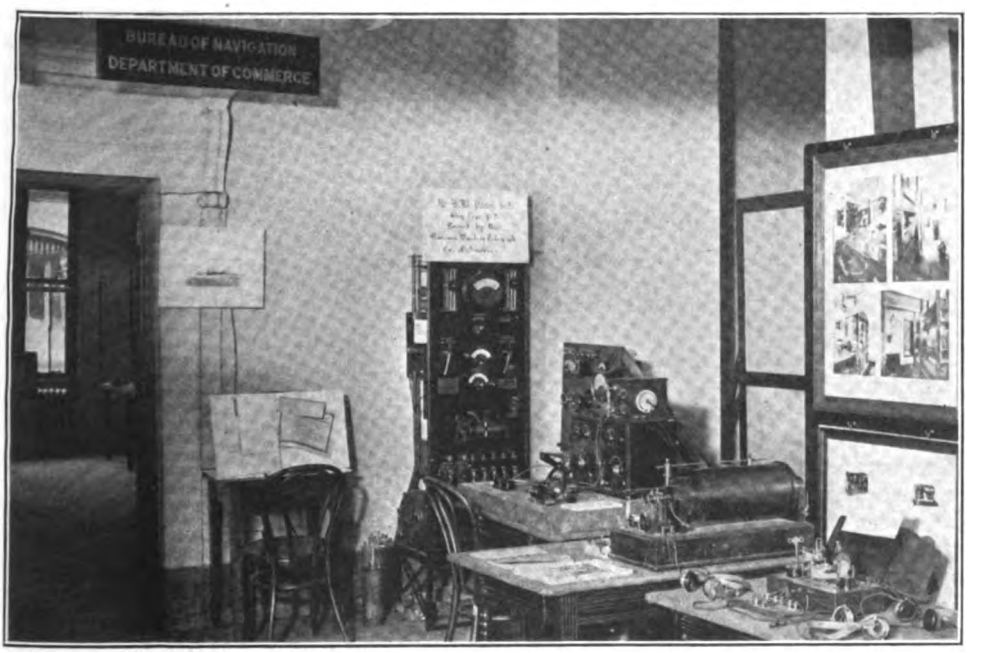
# New Standardized Ship Set at the Safety First Exhibition

### Record of Life Protection by Wireless Shown by Chart in the National Museum in Washington

A ½-k.w. Marconi panel set loaned to the Department of Commerce by the Marconi Wireless Telegraph Company of America to demonstrate a complete marine wireless equipment was a feature of the Safety First Exhibition, which was opened in the National Museum, Washington, D. C., on February 21. The Bureau of Navigation detailed two men in charge of W. D. Terrell, who devoted their time to explaining the apparatus and demonstrating with a temporary antenna by means of which visitors were able to listen in to messages from the Arlington station. Thirty-five thousand persons attended the exhibition. The Department of Commerce showed by a chart, that of the vessels equipped with wireless, clearing from United States ports last year, twenty-five had met with disaster, but only two lives had been lost.




*The complete Marconi ship equipment shown at the Government Safety First Exhibition*

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# With the Amateurs

The Dallas Radio Club has received a charter from the National Amateur Wireless Association. A notice to this effect from the national organization was read at a meeting of the club held recently at the residence of Ben Emerson.

The matter of permanent quarters for the club was discussed at length. This matter is to be definitely settled at the next meeting.

Several new members have been admitted to membership. All members of the club are requested to get into communication with M. L. Hunt, the secretary, so their names may be properly placed on the rolls of the organization.

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The latest is the wireless news service for farmers' clubs. John Baldwin a graduate of the University of North Dakota, where he made a study of wireless, has installed an apparatus at his home.

On club meeting nights, Baldwin retirés to his wireless station, and getting in touch with the station at the University of North Dakota, he is informed of the day's new developments.

For instance, flood damage in Illinois, the Great Northern train wreck in the Cascades and several similar items were flashed to Baldwin, and a half hour later, at the farmers' club meeting, Baldwin was reading the world's news by wireless.

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Brown University will offer a course in practical and experimental wireless telegraphy to students in the department of electrical engineering. The course is to be elective to any student in the University.

The equipment is of the latest type. The towers will support a 450-ft. aerial. Two wires stretched apart on bamboo spreaders twelve feet wide, make up the aerial, which is of the L type.

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The Radio Club of New Britain, Conn., held a meeting recently at the Y. M. C. A. President Mulvihill presided.

The meeting marked a record night for the club as regards good attendance. President Mulvihill wishes to make known the fact that the club was not organized for amateur wireless operators alone, but for every person interested in wireless telegraphy. The club extends an invitation to all attracted by the art to attend its meetings, which are held in the Y. M. C. A. every Tuesday evening.

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The Bridgeton (N. J.) Wireless Club, is desirous of interesting many more in radio communication and of increasing and advancing the study of wireless in all its forms. William S. Fithian is secretary of the club. There are now six licensed amateur wireless stations in Bridgeton, and one station is equipped with receiving apparatus only.

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A Milwaukee boy, Carl F. Kottler, of No. 1035 Second street, now a sophomore in the school of engineering at the University of Wisconsin, received a message sent by wireless from Eilvese, Germany, which contained war orders. Experiments were being made with the wireless apparatus at the university when the message was caught. Kottler was one of the first Milwaukee youths to install his own equipment.

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A new wireless club under the name of the San Francisco Radio Club has been formed in San Francisco. The club already has a membership of thirty operators. Among them are E. D. Stevens, Paul Fenner, E. R. Riddle and H. W. Dickow.

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The Wireless Club has been reorganized among the students of the University of Pennsylvania, with a large membership. The original club was described as one of the first organizations of its kind in America.



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The course in radio engineering to be given at Tufts College, began in February. It is an elective one for seniors and juniors in the engineering school. The theory will be taught by Professor William L. Hooper, head of the electrical engineering department, and H. S. Power will instruct in practical work in the laboratory.

The president of the Tufts Wireless Society is E. W. Bearse, '17, of Somerville. S. R. Wainwright, '18, of Andover is vice-president and Guy R. Entwistle of Malden is treasurer and secretary. There are about thirty members actively engaged in experimentation.

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The Lake Shore Radio Association held its semi-monthly meeting at the home of its treasurer, Fred Bubb, of 221 Steele street, Jamestown, N. Y., on the evening of March 2. Two new members joined the association.

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Case School has now a wireless station, which is described as the second largest installation in Ohio. Professor H. B. Dates purchased the apparatus from the Marconi Company and presented it to the school.

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Captain Sidney V. D. Levine, in charge of the Barnert Memorial Boy Scouts, of Paterson, N. J., has announced that a wireless telegraph corps of eight members is being formed.

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Receiving wireless messages atop the tall building of the Greenpoint Y. M. C. A. at Meserole avenue and Lorimer street, Brooklyn, N. Y., is a popular pastime among the younger members of the branch. Under the direction of H. N. Baker, assistant director of boys' work, a wireless club has been formed with Charles Clarke as president, Stanley Goodwin, vice-president, and Norman Keith, secretary.

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Wireless telegraphy has attracted the attention of many ingenious and scientifically inclined young men and boys in Troy, New York, with the result that there are at present a large number of amateur stations. The young operators have made records for receiving and sending which are exceptionally good. Most of the local stations are the handiwork of the owners who have built their own sets of instruments and brought them up to their present workable condition. The common interests of these young experimenters brought them together in the formation of the Amateur Marconi Radio Association of Troy and vicinity, which last month celebrated its first anniversary. The club is affiliated with the National Amateur Wireless Association. The officers of the year are: President, Wendell King; vice-president, William Le May; secretary, Malcolm Williams, and treasurer, John Vaughn. When organized, the association had a membership of eight, but now has twenty-five members, five of the number having received United States government wireless licenses. The club meets bi-monthly at the Lansingburgh Y. M. C. A., where the problems of wireless communication and the study of electricity are taken up, with many interesting discussions.

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The third meeting of the Rock Island Wireless Club was held in the older boys' room of the Rock Island Y. M. C. A. on the evening of February 29. Fourteen were present. Ben Sperbeck, president of the club, led a discussion on "The Connections of Receiving Instruments."

The club chose as its name, "The Rock Island Radio Club." A committee was appointed to formulate a constitution and another to set the dues.

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Plans for the amalgamation of the four amateur wireless clubs of Trenton, N. J., were discussed at a dinner given by the Radio Association at Central Y. M. C. A. on the evening of March 2. E. T. Rossi, district superintendent of the Public Service Corporation talked interestingly of wireless telegraphy. Those present were : Edward G. Raser, Robert W. Lister, J. E. Pritchard, N. R. Steward, W. Perry, George N. Hill, T. Howard Atkinson, R. J. Brown, L. Lewis, Emery Parichy, William Goldstein, Frank H. Silvers, Martin K. Pillsbury, Ernest Johnson, Mr. Berry and Mr. Hughes.

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# Some "Don'ts"

1. Don't reduce the power of the new 2 k.w. 500 cycle quenched spark transmitting set without readjusting the generator voltage for a clear spark note. It is disagreeable to copy a message sent by an irregular or broken-up spark note.
2. Don't operate this set at full power when within fifty miles of a shore station—it causes unnecessary interference.
3. Don't use the 600 meter wave in communicating with a ship almost visible on the horizon—make a brief call on the standard wave of 600 meters and then cut down to 300 meters.
4. Don't call a shore station until you have first ascertained whether it is in the act of receiving—carefully adjust your receiving tuner to determine the general conditions of the ether about you.
5. Don't try to develop an original style of sending. Avoid a jerky, irregular method of formation—listen to the Marconi station at Cape Cod, which employs an automatic transmitter with perfect formation of the code characters. Imitate it.
6. Don't congest the ether with useless dots and dashes, queries, remarks, etc.—it is a violation of the International Regulations and appropriate abbreviations have been adopted for use.
7. Don't put your transmitting apparatus out of commission because the aerial ammeter fails to indicate—the meter may be burned out and the set still be in good condition. Shunt the meter with a piece of stout copper wire.
8. Don't notify the port inspector or the superintendent of the maintenance department that your head telephones are out of order and leave them on the ship—bring them to the shop and have them repaired.
9. Don't leave the ports of the wireless cabin open in damp climates while you are absent from the ship—it destroys the insulation of the set.
10. Don't allow the room steward to shine the brass of your apparatus without afterward making a personal inspection of the position of the helix clips—refer to the tuning card and replace the plugs in their proper positions:
11. Don't wait until the bearings of the motor generator "squeak" for lack of oil—make a daily inspection of the oil gauge. The room steward may have unintentionally opened the drain cock with his broom and drained the oil well.
12. Don't become alarmed if a hurricane destroys the greater portion of your aerial—stretch a single wire between the masts or between one mast and the smoke funnels. The set will transmit almost as far as with a standard aerial.
13. Don't forget, under such conditions, to retune the set to resonance by means of the aerial ammeter to one of the standard wave-lengths, 300, 450 or 600 meters.
14. Don't widen out the gap of the synchronous rotary disc discharger abnormally—it will puncture the condensers. The standard gap for the 2 k.w., 500 cycle set is .005 of an inch.
15. Don't tell the government inspector that your 2 k.w. set consumes 500 watts—it is designed to consume 2,000 watts at normal rating, but may be operated at lower powers if necessary.
16. Don't attempt to regulate the spark note by means of the motor field rheostat—use the generator field rheostat, which was intended for the purpose. If the source of current supply remains at a constant potential, the motor field rheostat need not be touched.
17. Don't allow carbon granules, copper dust., etc., to accumulate on the brushholders of the motor—you cannot expect the brushes to move freely under these conditions, and in consequence you will not have sparkless commutation.
18. Don't drop the receiving telephones on the table—the shock will destroy the magnetism of the permanent magnets.



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# The Construction of a Precision Detector

By Charles Horton

FROM time to time there have appeared in the various magazines devoted to wireless telegraphy and telephony, articles dealing with crystal detectors having very accurate adjusting means. Some of these accurate detectors have been so constructed that by the use of a set of micrometer screws it is possible to set the contact point on the surface of the crystal in thousands of different positions, thus allowing the thorough searching of the sensitive surface and the selection and recording of the points which show sensitivity of a higher order.

On account of the great accuracy necessary in the design of these detectors, the construction has been confined to experimenters possessing the tools and the high order of skill required, consequently there have been few of these instruments in use among amateurs. The writer has given considerable thought to the problem of constructing a practical precision detector which would permit of accurate adjustment and yet require in its construction no more than usual accuracy, and it is the purpose of this article to show how this can be done.

The principle embodied in the design will be made clear by an examination of the accompanying drawings in which Fig. 1 is a top view of the instrument, Fig. 2 a side elevation in which the cover is shown in section and certain of the parts are broken away to show details of construction, and Fig. 3 a side elevation of the instrument.

The crystal is mounted in the usual cup by means of Wood's metal, and the cup then mounted in a hard rubber block which is itself screwed upon a circular wood disk in such a position that the center of the cup is eccentric with the center of the disk, while the contact point is mounted independently of the disk in a position directly above the center of the cup. It is evident that when the disk is revolved about its center that all points on the crystal surface will travel in circles about that center and the contact point will describe on the crystal a circle or a part of a circle. The disk referred to is itself mounted upon

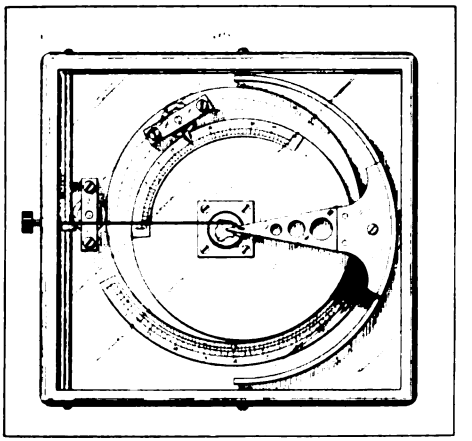

*Fig. 1*

a second and larger disk with its center eccentric to the center of the latter, so that when this second disk is rotated about its center, the points of the crystal surface describe circles about this new center and the contact point describes on the surface of the crystal a circle crossing the first.

Upon careful consideration of this arrangement it becomes evident that by the proper rotation of these two disks the contact point can be made to touch any part of the crystal surface. Furthermore, since the center of the crystal is mounted quite near to the center of the disks and the disks are quite large in proportion, it follows that a movement of a part of an inch on the periphery of either disk amounts to but a small fraction of an inch at the center of the crystal. This ratio is made greater and a



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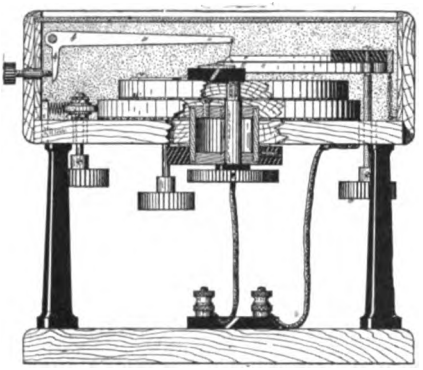

*Fig. 2*

means of adjustment is provided by the use of two rubber rollers which roll on the periphery of the disks which are covered with very fine emery cloth to insure frictional engagement. The disks are further provided with scales to allow a record to be made and kept.

The friction rollers are mounted on shafts which project through the bottom of the detector case and have knurled knobs at their ends. In order to allow the crystal to be moved relatively large distances the disks are provided with knurled knobs at their centers which permit of direct movement of them. The contact point is mounted at the end of a triangular flat spring which is itself so mounted that its center of rotation is a short distance from the point, thus permitting the use of a lever arrangement for reducing the movement of the adjustment screw when transmitted to the point.

It will also be noted that when the point is brought against the surface of the crystal and the adjusting screw revolved further that the flat spring is bent more and more, thus bring more and more pressure to bear on the crystal, but preventing injury to the point. For raising the spring when moving the crystal in large amounts there is provided a set screw and a co-operating lever. The arrangement used permits of a dust tight case with, however, perfect adjustment. The action of the parts is at all times apparent through the glass top.

The detailed construction of the detector will now be taken up. Detail No. 1 is the surbase of the instrument and should be made of oak or mahogany. When the instrument is finished a sheet of felt is glued on the bottom of this piece. The two large holes at the top of the drawing are for the binding post, nut and screw.

Detail No. 2 is the supporting posts for the detector proper. If the instrument is made of oak these posts show up nicely when made of hard rubber or blacked and polished wood. For mahogany, however, yellow finished brass posts present a fine appearance. Detail No. 3 is the hard rubber panel on which the binding posts are mounted and needs no explanation. Detail No. 4 is the base of the detector proper and is mounted on the posts, Detail No. 2. Detail No. 5 is the larger of the two rotating disks and is made exactly as shown.

Detail No. 6 is the smaller of the two disks and has holes drilled to receive the flat head wood screws with which the cup holder is screwed to it. These holes are drilled considerably smaller than the screws to insure good purchase. Details Nos. 7, 8 and 9 are parts of the pillar which supports the two disks. These should be very carefully made as they determine the accuracy of the instrument. Detail No. 10 is the upper and lower brackets of the rubber roller bearings. Detail No. 11 is the separating pieces for the same and are made according to the size of the rollers when completed.

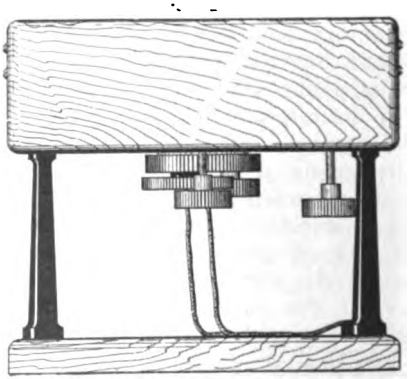

*Fig. 3*

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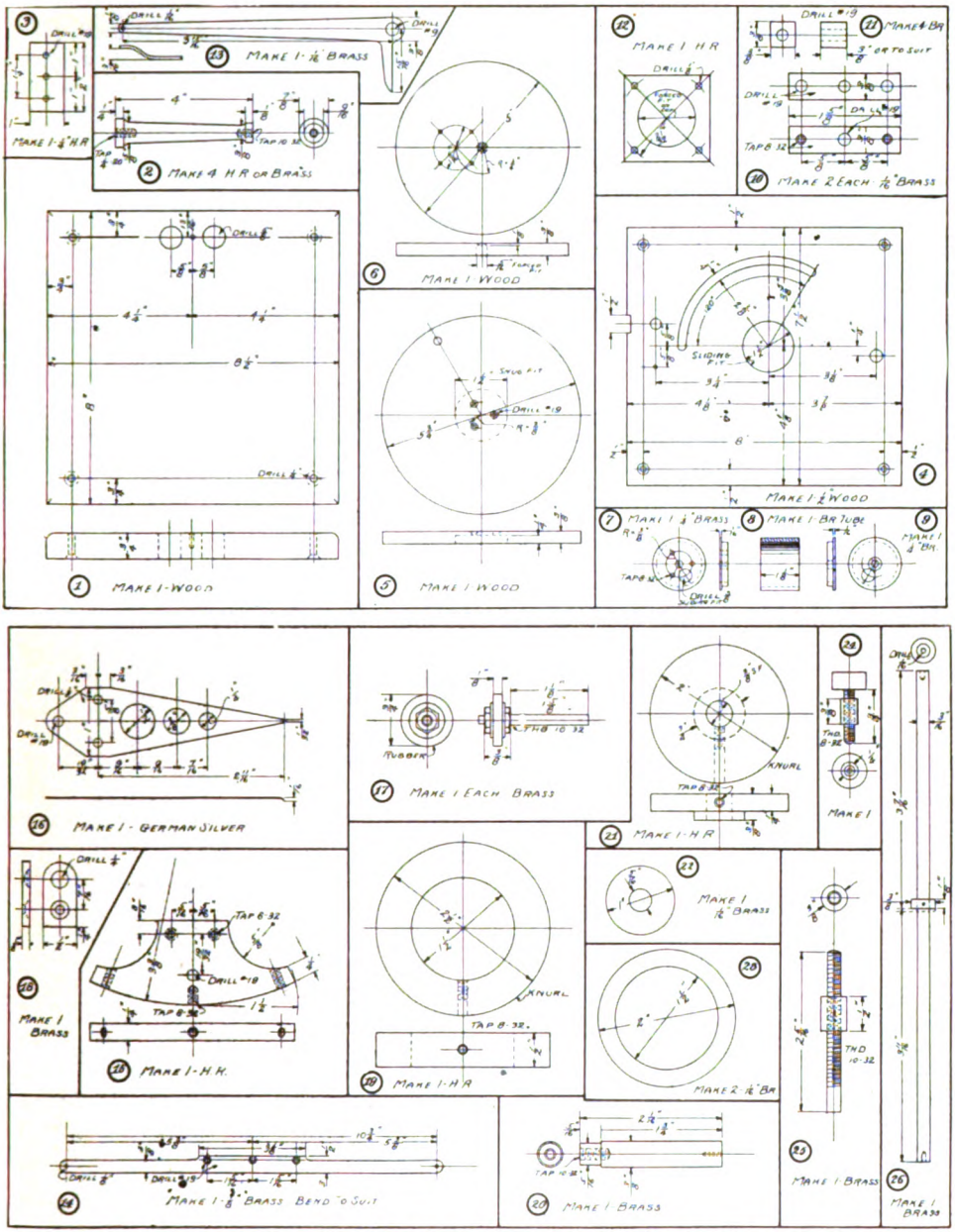


*Detail drawings*

Detail No. 12 is the crystal cup supporting block. The cup containing the crystal is forced into the same by the use of the vise as a press. Only a little pressure should be required or else the block is apt to split.

Detail No. 13 is the contact spring lifting lever and is intended to be mounted on the shaft. Detail No. 26 is the position shown by the dotted lines and should be soldered in position. Detail No. 14 is the yoke on which the contact spring is mounted and is pivoted on two screws, one at each side of the cover of the detector, as seen in Fig. 1.

Detail No. 15 is the hard rubber mounting for the detector spring and is screwed to the yoke just described by

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means of three flat head brass machine screws. The tap hole in this piece at the bottom in the drawing is drilled and tapped at the time the piece is made but the other two holes are drilled when the brass yoke has been bent into contact with the rubber piece. This is to insure perfect alignment.

Detail No. 16 is the contact spring itself. It can be made of German silver or phosphor bronze and should be about eight-thousandths of an inch in thickness. The point should be rounded.

Detail No. 17 is the rubber rollers for bearing on the disks. The rubber part is from a pair of circular typewriter rubbers and is made true round by mounting as in the drawing and spinning the whole in the lathe while a piece of sandpaper is brought against it. The rod used is No. 9 drill gauge size and is threaded for a distance of half an inch. The several parts are then mounted and the projecting piece of the rod turned down to No. 19 drill gauge size. To insure no slipping of the rubber a pin may be put through the rubber and the two brass washers.

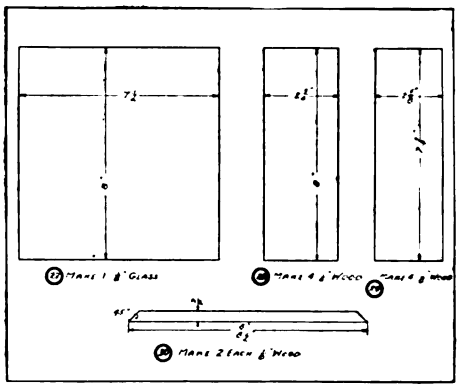
Detail No. 18 is the spring abutment for the bracket which bears on the large disk. This bracket is screwed to the base in only one place in order that the spring may act to cause perfect engagement.

Detail No. 19 is the adjusting ring for the large disk. Detail No. 20 is the shaft for the small disk. Detail No. 21 is the adjusting knob for the small disk. Detail No. 22 is the washer which separates the two disks. Detail No. 23 is the two washers which mount the large disk on the base of the detector.

Detail No. 24 is the adjusting screw and bushing for the spring lifting lever. Detail No. 25 is the threaded rod for the spring tension adjustment. For grips on this and the rods of No. 17 ordinary typewriter knobs are specified. Detail No. 26 is the raising lever shaft beforementioned. Detail No. 27 is the glass top for the cover. The dimensions given are the maximum, and it is best to cut somewhat under them in order to insure a fit in the cover.

Detail No. 28 is the four sides of the cover which are to be glued together, brads being used if necessary. Detail No. 30 are then glued on the top edges of the cover thus made, which forms a ridge for the glass to rest against. The parts (detail No. 29) are then glued or screwed inside the case to keep the glass from falling out. When all wood parts are glued together the corners are rounded off as shown in the figures, and the bottom planed off. Holes are drilled in the two long sides at the two following points: an 8/32 tapped hole in each long side 5/8 of an inch from the end, and 2¼ inches from the bottom edge, and an 8/32 tapped hole on each of the same sides 4½ inches from the same end, and 1¾ inches from the bottom edge. Also, on the end from which the measurements were taken, one ¼ inch hole 3 13/16 inches from the left hand side and 1½ inches from the bottom edge.

Care should be taken when assembling



*Detail drawings*

the detector to see that the disks rotate freely, but have no play in their bearings. The bearings may be coated with graphite before assembling. The disks are to be covered on the edges with a strip of very fine emery cloth or sandpaper, and for their under edges with fine velvet to keep out dust.

The connection to the cup is made by running a wire from its under side (to which it should be soldered), to the top of the shaft. Detail No. 20, which shaft has a flexible lead soldered to the center in the hole provided connected to one binding post. The other connection is made by connecting the other lead to the bushing of the spring adjusting screw which contacts with the switch point on the hard rubber support for the spring.

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The total movement of each disk is arranged to be 120 degrees and the scale is divided into fifty parts. It is evident that a movement of one division on a disk moves the center of the crystal about .015 of an inch. Thus it is evident that very accurate adjustment can be secured.

This detector is designed for the use of silicon, but any other mineral can be used, and if the contact is constructed to have mounted at its tip a piece of pyrites, the perikon combination may be secured.

This instrument, if carefuly made, will be found very serviceable and present a handsome appearance.

## MEDICAL ADVICE BY WIRELESS

Master Frederick VIII: Pls have your Dr. state symptoms and treatment of appendicitis immediately.

Capt. Banvard.

This was the message from the Standard Oil tanker Brindilla, which was delivered to the captain of the Scandinavian-American liner Frederick VIII. by his wireless operator on the evening of February 12 while the vessels were at sea. The ship's surgeon immediately diagnosed the case and directed by wireless the treatment given the patient by the captain of the Standard Oil tanker. Under the doctor's instruction, Captain Banvard administered opium and applied ice bags, continuing this treatment until the ship reached port.

## A NOVEL MARRIAGE PROPOSAL

A newspaper relates that a new feature of wireless telegraphy has recently had a demonstration in Connecticut. A young couple in the Nutmeg State had a misunderstanding. The young man started for the West Indies on a fruit steamer. Along came Saint Valentine's day, and the young woman changed her mind. Her sweetheart was well out to sea on his voyage. She bethought herself of the wireless and sent through the air the statement: "I have changed my mind. This is leap year. Will you have me?" This brought a quick response: "A great valentine. Will return by next boat."

Wireless telegraphy has been useful in a great many ways, bearing messages of war, of peace, of business, of sorrow, of joy and of love and perhaps hatred, but this is said to be the first time on record that a proposal of marriage was ever made by marconigram by a young woman, and acceptance returned by the same means.

## MARCONI SETS DESCRIBED AT INSTITUTE MEETING

At a meeting of the Institute of Radio Engineers, held at the Engineering Societies Building, 33 West 39th street, New York City, on the evening of March 1, Harry Shoemaker, research engineer of the Marconi Wireless Telegraph Company of America, read a paper on "Recent Standard Radio Sets." He described in detail two types of standard wireless sets which the company has placed on several hundred ships. The paper was discussed by Professors A. N. Goldsmith and J. Zenneck, Dr. E. F. W. Alexanderson, R. H. Langley, L. R. Krumm, chief United States radio inspector, and David Sarnoff, assistant traffic manager of the Marconi Wireless Telegraph Company of America, who described the operation of the sets used in the Marconi service.

## TOWING HALF WAY AROUND THE WORLD

The longest tow in the history of shipping oil began recently, when the California Standard Oil Company's steamship Richmond steamed away from Bayonne, N. J., on her way to Shanghai, China, with the Standard Oil barge No. 95 in tow. Both vessels are equipped with Marconi wireless sets. They are carrying a total of nearly 3,000,000 gallons of oil.

## WIRELESS TELEPHONE PROGRESS IN THE NAVY

Wireless telephone communication between ships for the transmission of orders in movements at sea took place recently in the Atlantic fleet in the maneuvers off Guantanamo. The instruments were operated on the battleships Wyoming and Texas and Lieutenant William Furlong, fleet radio officer, was placed in charge of the work.

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# "Bucking" the Great Lakes Ice-Jams

## Difficulties of Navigating the Inland Seas in the Winter

ALL along the shores of the Great Lakes, from Buffalo to Duluth, there is bustle and activity among wireless and shipping men; for the navigating season proper has just opened, the ice is beginning to disappear, and vessels which have been laid up for the winter are leaving their havens. From April until December an endless procession of ships passes through the Soo and fleets comprising many vessels discharge their cargoes at the various ports. But when the lakes are covered with ice and chill winds sweep across the frozen surface, the greater number of these craft seek refuge behind breakwaters or in rivers. Some of the ships continue to ply the waters, however, despite the difficulties of navigation.

*An ice-encased car ferry in Lake Erie on January 30 last*

Wireless operators who were detailed on vessels that were in service on Lake Michigan in February, 1915, well remember the sea of slush ice through which the ships were compelled to plough. Low temperature and snow storms brought about this condition. On February 4 seventeen vessels, among them being the steamship George, were imprisoned in ice-jams in various parts of the lake. The situation of those on the vessels was far from enviable, but it was alleviated considerably by the Marconi operators on the craft who established communication with the shore stations and sent information concerning the marooned folk.

There is no lack of thrilling experiences for the wireless men who voyage the Great Lakes in the winter months. An illustration of this statement is contained in the story of the wreck of the steamer Iowa which was crushed in the ice in Lake Michigan off the mouth of the Chicago River on January 3, 1915. The Iowa, with George Keefe in the wireless cabin, was bound from Milwaukee to Chicago. Four miles off the Government lighthouse she became wedged in the ice. Gradually the frozen cakes closed in on the vessel and a hole was torn in her bottom. Through this the water poured in



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such great volume that she began to sink.

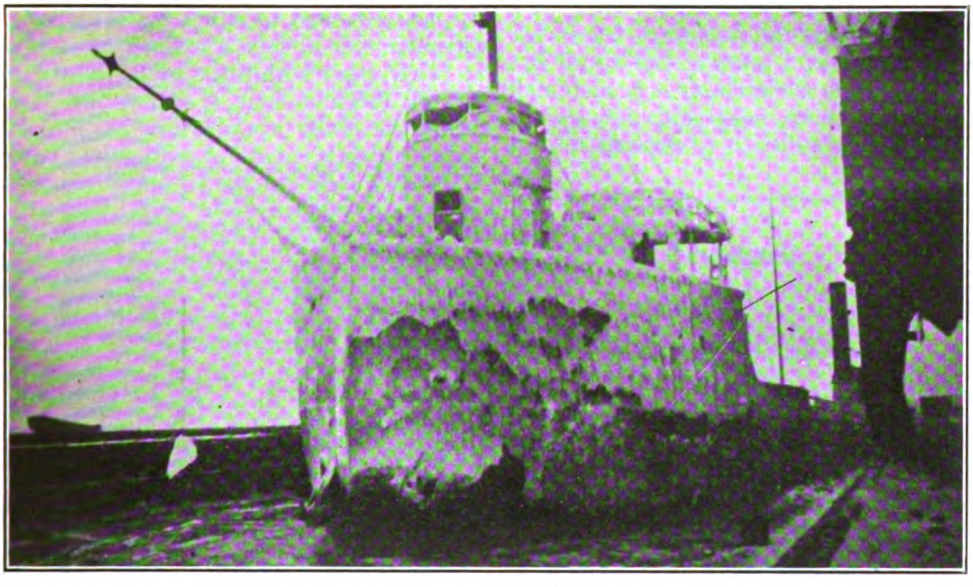
Keefe, in the meantime, had not been idle. He sent out the S O S, and tugs were started to the rescue. The vessel was settling in the water so rapidly, however, that the crew of seventy and one passenger clambered over the side of the vessel on to the ice. Keefe remainted at his post to flash the appeal for aid until five minutes before the Iowa sank, when he joined the others, and made his way to the shore by walking—a distance of a mile and a half.

There are, of course, other perils incidental to navigation in addition to those resulting from the formation of ice. Car ferry Pere Marquette No. 19, with Marconi Operator Millgard on board, ran aground in Lake Michigan, about four miles north of Ludington, Mich., early in the evening of January 17 last. Millgard used the wireless to obtain aid and Pere Marquette steamers Nos. 17 and 18 sent word that they were ready to go to the assistance of the stranded vessel. They were informed, however, that because of the heavy seas and the shallow water, it would not be safe to make the attempt.

Messages were exchanged between the 19 and the officers of the Pere Marquette company until three o'clock in the morning of the following day. At that time Millgard reported that the water had reached the boiler room, and that he would only have power for a few more minutes to operate the set.

The life-savers were not idle meanwhile, and the members of the vessel's crew were kept informed by wireless regarding the progress of the efforts being made to effect a rescue. Those on the 19 were taken ashore on the afternoon of January 18. The vessel, which was considerably damaged, was towed to dry dock.

The incidents related in this article are brief examples of the events which go to make up the life of an operator on Great Lakes craft. To be sure he does not have the opportunity given to his brother of the Atlantic or Pacific vessels for long distance communication, but he does have frequent occasion to display his courage and judgment when these qualities are essential. And, like the wireless man of the salt water craft, he has shown that he is not lacking in either.



*The vessel pictured in this photograph shows plainly the effects of battling with ice and storm. The camera man snapped her at Rondeau, Lake Erie*

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It is reported from Rome that the organization of an Italian aviation ministry, with Guglielmo Marconi as its head, is about to be effected.

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# From and For those who help themselves

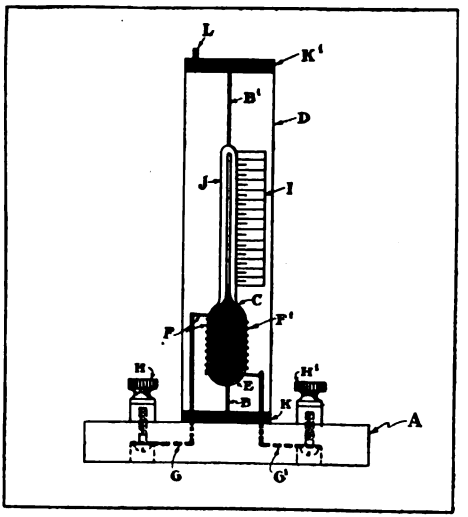
## Experimenters' Experiences.

*The editor of this department will give preferential attention to contributions containing full constructional details, in addition to drawings.*

### FIRST PRIZE, TEN DOLLARS

### The Construction of an Aerial Hot Wire Ammeter

When lacking the necessary funds for the purchase of a commercial aerial hot wire ammeter, the amateur is accustomed to resort to many make-shift devices for determining conditions of resonance in a




*Drawing, First Prize Article*

wireless telegraph transmitter. In fact, it is generally recognized that the construction of a good aerial ammeter presents a problem not easily solved. With this point in view, I intend to present the details of construction for an ammeter which I worked out, and which I believe to be of suitable range for the average amateur station.

Referring to Fig. 1, a glass tube, D, is fitted with a wooden or a fibre stopper at both ends, K and K¹. Two wires, B and B¹, are attached to either end of a small thermometer in such a manner as to hold it fairly rigid within the tube. The bulb of the thermometer, E is ground down until the walls are as thin as possible after which it is wound with six or seven inches of No. 30 bare copper wire or special resistance wire with the turns slightly spaced. The terminals of this winding are connected to two soft copper wires (about No. 12), G and G¹, which are in turn fastened to the base of the binding post as indicated.

It is desirable to fit the ends of the glass tube, D, with the heads, K and K¹, so that they will be air tight. Then a small valve may be fitted to the bottom head, so that the air within the tube can be exhausted. This can be effectually accomplished by cutting a small rim in the heads of the glass tube, so that the glass will fit it very snugly. It can then be made air tight by pouring a good sealing compound, such as wax, etc., around the rim.

When the binding posts, H and H¹, are connected in series with the aerial system at any station, the small wire, F and F¹, becomes very hot, causing the mercury of the thermometer to rise. This instrument can be calibrated direct in amperes by connecting it in series with a standard ammeter, applying several values of current to the circuit and noting the corresponding deflection upon the small cardboard scale, I, which is attached immediately alongside the ther-



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mometer. The current for the calibration purposes may be supplied by a storage battery regulated by a small controlling rheostat. To insure greater protection against changes of temperature, the original tube, D, should be placed inside another tube, from which the air is exhausted.

It will be well for the experimenter to make several trial experiments with the wires, F, F¹, to determine the size most suited to the current flowing in the antenna circuit at his station; or if desired, a small shunt circuit consisting of a loop of copper wire may be connected across the terminals, H and H¹.

Frank K. Morse, *Colorado.*

is composed of a number of sheet steel strips 9 inches in length by 2 inches in width with an average thickness of 3/32 of an inch. Piled up, they appear as in Fig. 2. A sufficient number of strips are cut to make a core 2 inches square. Better results would be obtained by the use of silicon transformer steel, but good results are secured from ordinary soft sheet steel.

It will be noted from the drawings that the primary and secondary windings are wound on opposite legs of the core and held in place by cardboard forms 3 inches in diameter, which are slipped over and secured on the core. Fibre discs are inserted between the sections of the secondary windings and at other

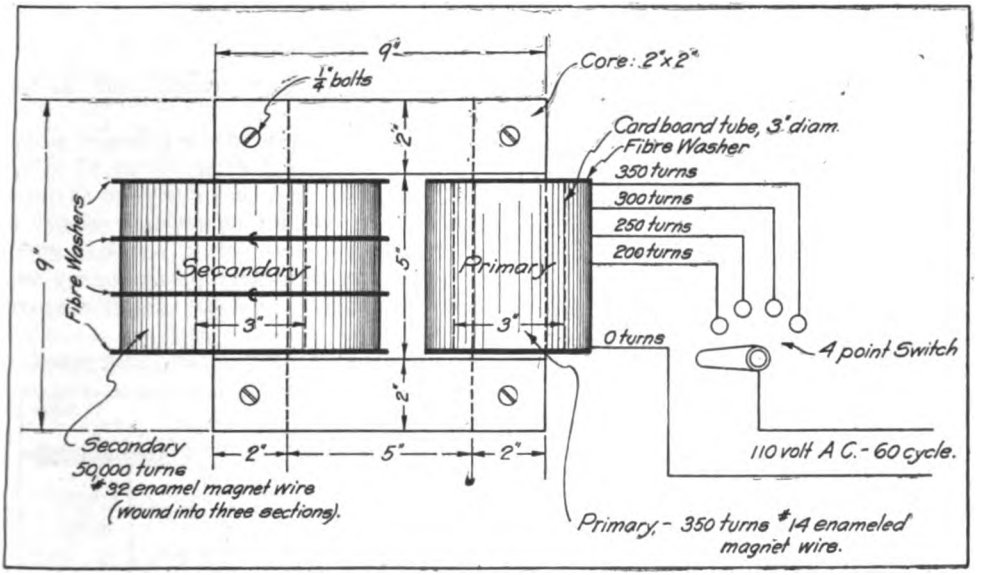


*Fig. 1, Second Prize Article*

## SECOND PRIZE, FIVE DOLLARS

### The Construction of a Closed Core High Potential Transformer

With the exception of the high potential transformer, the wireless experimenter with the average mechanical ability does not find it a difficult matter to construct the various parts of a complete wireless telegraph set. Amateurs who have arrived at this point in the design of their sets will profit by duplicating the closed core high potential transformer which I herewith describe.

As indicated by Figs. 1 and 2 the core

points, as shown in Fig. 1.

The primary winding consists of 350 turns of No. 14 enameled magnet wire wound on in even layers with sheets of empire cloth interposed between the layers. Taps are brought out from this winding to a multiple point switch from the following turns, namely 200, 250, 300, 350.

The secondary winding is composed of 50,000 turns of No. 34 enameled magnet wire, divided into three sections which are separated for purposes of insulation by means of a vulcanized fibre disc. The final secondary terminals are brought

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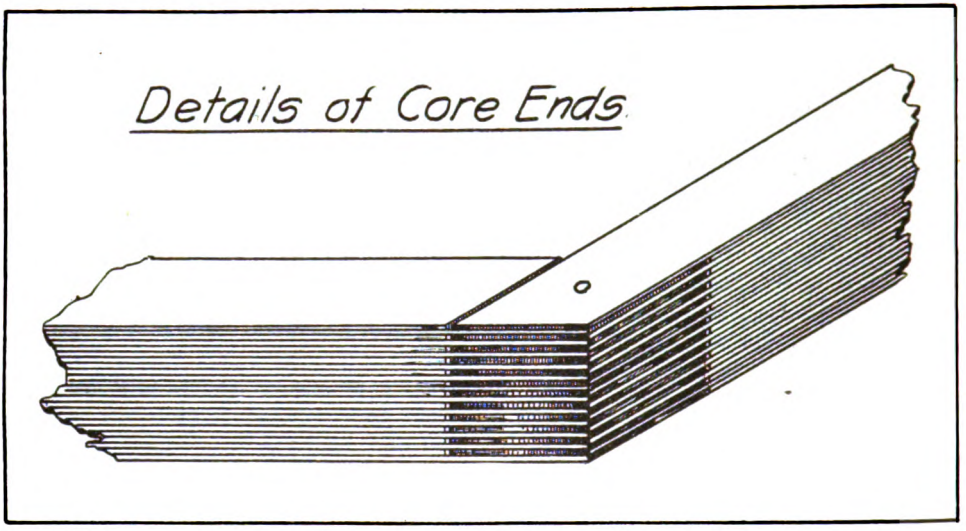


*Fig. 2, Second Prize Article*

through insulating tubes to high tension terminals mounted on the top of the containing case.

To give this transformer satisfactory operating characteristics and also to allow the power input to be varied over a considerable range, it is fitted with a magnetic leakage gap, which is controlled from the outside of the case by means of a suitable handle. The complete details for this gap are given in Figs. 3 and 4.

The design of the containing case for this transformer is left to the builder but it is preferably made of metal. The adjustment for the magnetic leakage gap is mounted on the outside of the case as well as the multiple point switch for the control of the number of turns in use at the primary winding.

In connecting together the secondary sections particular care should be taken to make sure that the current flows in the same direction around all of the coils.

After a suitable containing case is constructed, it should be filled with a good insulating compound or a good grade of transformer oil.

The cost of construction for this transformer will be found rather low, and owing to the value of secondary potentials it will be particularly applicable for amateur purposes; in fact, the potentials can be varied between 10,000 and 22,000 volts.

The power input to the primary winding may be varied from ¼ to ½ k. w.

The transformer was designed to operate on 110 volts alternating current at a frequency of 60 cycles, and has given completely satisfactory results in my station under all possible conditions of service.

MARK BISER, *Maryland.*

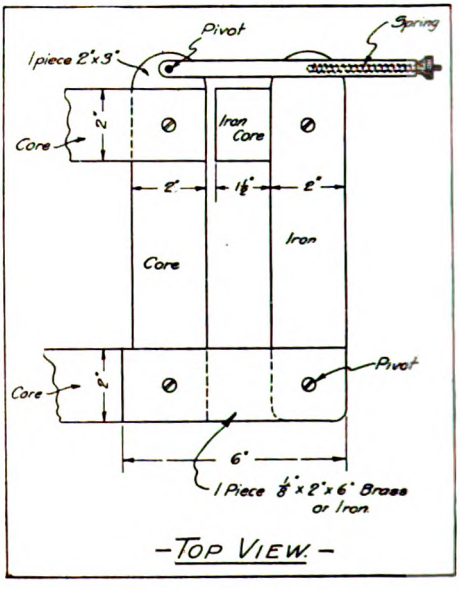


*Fig. 3, Second Prize Article*

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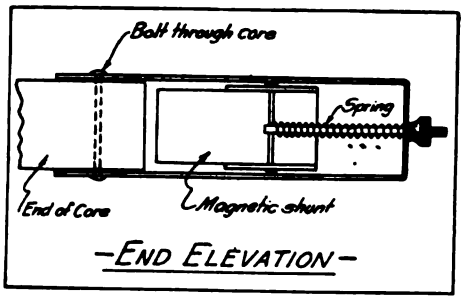


*Fig. 4, Second Prize Article*

## THIRD PRIZE, THREE DOLLARS

### A Suggested Design for a Compact Receiving Set

From the viewpoint of operating efficiency, a compactly mounted receiving equipment is a desirable fixture at any wireless station. It is a comparatively easy problem for the experimenter to design the detailed parts of a receiving set, but he is not always able to arrive at a quick decision regarding the construction of the cabinet for housing the various parts.

A front view of a complete tuner which I have designed and from which I have obtained extremely satisfactory results is shown in the front elevation in Fig. 1, with a corresponding end view in Fig. 2. The complete loose coupler is represented at A, the primary winding

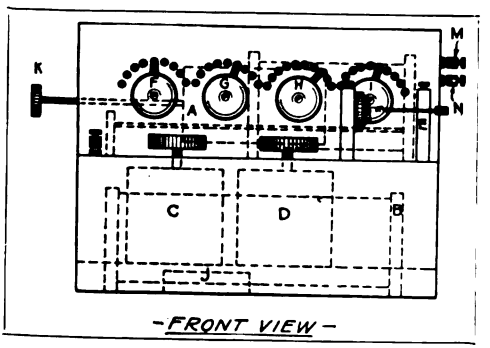


*Fig. 1, Third Prize Article*

of which is connected to the multi-point switches, H and I, while the turns of the secondary winding are connected to the multi-point switch, S. The primary winding is preferably made up of No. 24 S.S.C. wire, while the secondary winding is covered with No. 32 S.S.C. wire.

The coupling between the primary and secondary windings is regulated by the rod, K, which draws the secondary winding away from the primary over the two brass rods shown in Fig. 2.

A suitable loading coil for the tuner is mounted on the inside of the cabinet and the turns are connected to the points of the multi-point switch indicated at G. This coil can be conveniently made up of No. 20 or No. 22 S.S.C. wire. Two variable condensers, C and D, of standard make are mounted to the front of

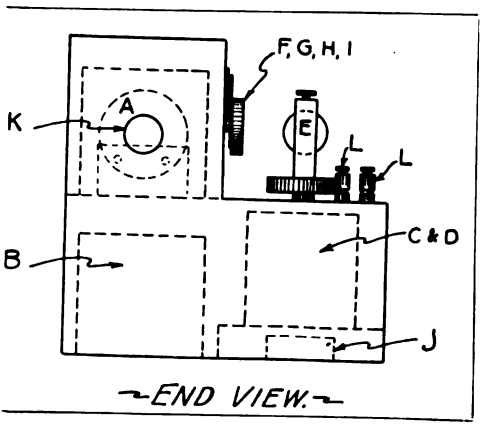


*Fig. 2, Third Prize Article*

the cabinet as indicated; one of these is connected in shunt to the primary winding, the other across the terminals of the secondary winding. Immediately underneath these condensers is placed the fixed condenser, J, and the binding posts for the telephones are indicated at L. The aerial and earth connections are attached to the binding posts M and N.

The foregoing description is not accompanied by dimensions, because the size of the cabinet will vary with the design of the tuning coil. The description given is merely intended to outline a convenient method for assembly of an amateur apparatus, and it will be evident that the operation of the equipment will be facilitated in every way.

WILLIAM GRIFFITH, *California.*

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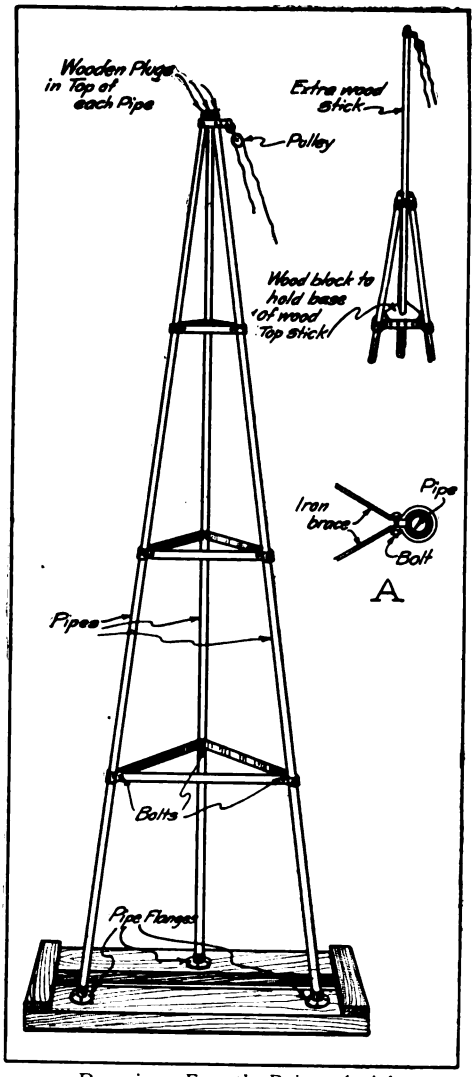


*Drawing, Fourth Prize Article*

## FOURTH PRIZE, SUBSCRIPTION TO THE WIRELESS AGE

### A Metallic Mast for a Wireless Telegraph Aerial

Users of iron piping for masts have found that they require excessive guying to hold them rigid, and to overcome this difficulty I designed the triangular tower, as shown in the accompanying drawing. I am sure that your readers will agree with me that it presents a neat, business-like appearance.

To simplify the description, a twenty-foot mast will be described. A glance at the drawing will convey to the reader's mind the essentials of my design. It consists of three lengths of pipe separated at their base by one-fifth of their length. At equidistant spaces they are bound together by an iron strap which is rigidly bolted to each pipe in the manner shown at the detail A. The strap passes part way around the pipe and a bolt is inserted as shown and screwed up tight.

A pulley for the aerial may be attached to the top of the frame, or if preferred, an extra length of wood may be used at the top to increase the height and improve the insulation. This can be accomplished by fastening a cross piece of wood at the first brace from the top, as shown, and by fastening the base of the top mast to this by means of a large lag screw. An iron band bolted around the top mast will hold everything firmly.

It is unnecessary to guy such a small mast, but in larger sizes, three guy wires should be attached to the top.

ROBERT KENNEDY, *New Jersey.*

## HONORARY MENTION

### An Electrolytic Interrupter Constructed by an Amateur

Since the rise in the price of batteries, I decided to construct an interrupter that could be used on 110 volts alternating current in series with an ordinary spark coil. I worked out the design in the following manner, and instructions to be given can easily be duplicated by the amateur experimenter.

Procure an old blue cell battery jar, or if there is none to be found an ordinary quart fruit jar will do. Now, place a thin piece of wood over the top of this jar and draw a line on the wood around the top of the jar. Then cut a circular groove in the wood to keep it from sliding off the top.

Next procure an ordinary six-inch test tube, hold the end in a Bunsen flame and blow into the mouth of it. If the hole is blown too large, hold the tube in the flame and it will fuse together. It is generally found that a hole about the size of a lead pencil point will give the most satisfactory result. Sometimes two or three holes in the bottom of the tube are better than one, but the best results are found by experiment. Now, drill a

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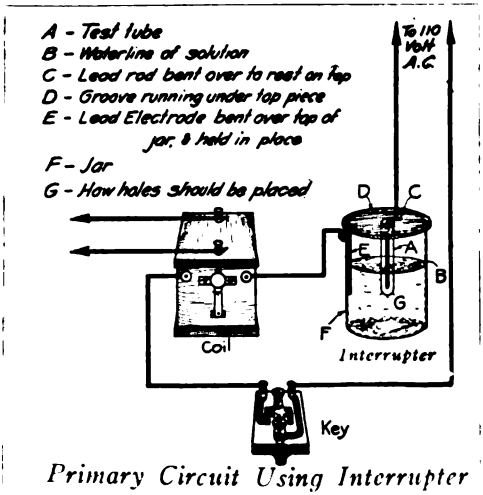


*Primary Circuit Using Interrupter*

*Drawing, Honorary Mention Article, E. Lawrence Chalmers*

hole through the center of the wood top according to the size of the tube. Place the tube in the hole and lower it so the flange around the top of the tube just rests upon the wood top. The top of the test tube and jar being ready, the only remaining materials required are the electrodes and a solution of sulphuric acid and water.

The best material for the electrodes is lead; two thin strips are needed, one to go into the tube and the other to hang down the side of the jar into the acid. A binding post or battery nut can be easily attached to the top of the strips.

The solution is mixed in the following manner: Always place the water in the jar first, filling it about half full. Now pour a few drops of the acid into the water and test the spark. If the jar buzzes quite loudly and the spark is "fat," the interrupter is complete. If otherwise, put a few drops more into the water and so on. Here again the best results are obtained by experiment.

Do not forget that the vibrator on the spark coil must be screwed up tight, so that there can be no possible vibration.

E. Lawrence Chalmers, *New Jersey.*

## HONORARY MENTION

### Design for Spark Plug Transmitting Set.

It is not always easy for the amateur experimenter to formulate the design for a compact transmitting set. It is the general custom to spread the parts of a transmitting apparatus over the instrument table which in some cases is not conductive to efficiency. The set to be described has the advantage over the ordinary one because it is compact, has a much neater appearanc, is more easily operated and allows the use of short wires between the component parts of the apparatus. It will be noticed from the accompanying diagrams that the induction coil is mounted to the right hand side of the cabinet, the spark gap directly above, the oscillation transformer on the top to the left and the aerial switch inside, as shown in the details (Fig. 2.)

The cabinet should have sufficient dimensions so that when the coil is laid in crosswise there is enough room at the right for the aerial switch and in the rear for the sending condenser. A space is now cut out of the left side of the cabinet so that when the top and bottom of the coil are taken off the vibrator end of the coil just fits. The oscillation transformer is made of edgewise wound copper strips mounted on hard rubber or bakelite standard. A fixed or quenched gap is mounted on the right hand front of the cabinet with a hard rubber face countersunk into it. Care should be taken not to let the connecting leads touch any wood. The aerial switch is mounted on the right hand front of the cabinet and thoroughly insulated with hard rubber.

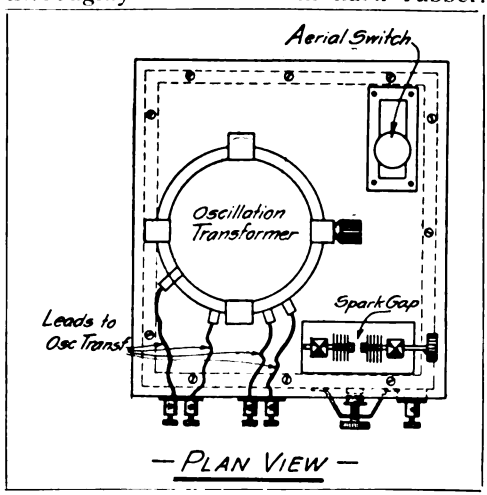


*Fig. 1, Honorary Mention Article, Francis R. Pray*

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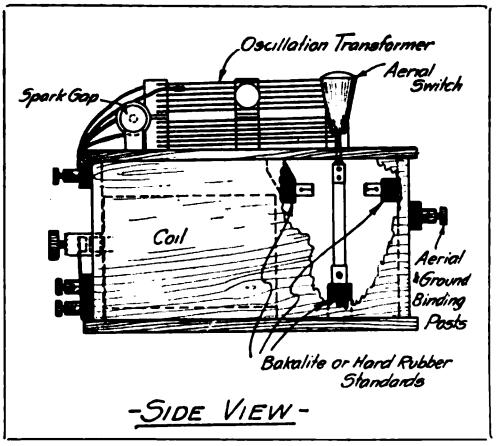


*Fig. 2, Honorary Mention Article, Francis R. Pray*

The binding posts should be mounted on a small hard rubber panel countersunk into the cabinet. The binding post for connecting the oscillation transformer and key are on the left side, and the ones for the battery, aerial and ground on the right side. The placing of the receiving binding posts is optional with the builder. Dimensions have not been given as they will differ according to the size of the apparatus.

FRANCIS R. PRAY, *Massachusetts.*

## HONORARY MENTION

### How to Make Cardboard Tubes for Tuning Coils

I find that many amateurs when making tuners or loose couplers are confused when they come to the cardboard tube problem. They either do not know where to buy the tubes or cannot make them successfully. I have had this trouble myself, but have succeeded at last in making them very cheaply with little time and trouble.

In making the tube the first thing to do is to secure a cylinder of the desired length and diameter. Next get some thin cardboard or thick paper. Wind the paper or cardboard around the cylinder. After the first layer has been applied, coat the inside of the paper with glue to make the layers stick together. When the paper has been wound, put elastic bands around the tube to prevent the paper from becoming loose. The tube thoroughly dry, take it off the cylinder and coat the inside with shellac. This strengthens the tube very much. It is now ready for use.

ALBERT KILLMEYER, *New York.*

## HONORARY MENTION

### Hearing Arlington and Other Stations by Means of a Simple Equipment

For the benefit of amateurs who believe that ideal conditions are necessary for the reception of signals from stations located at a considerable distance, I wish to tell something of the performance of a simple wireless telegraph outfit during the summer months.

About two years ago I visited the Maine coast and of course I took along my receiving outfit consisting of a loose coupler of generous dimensions, a galena detector and a pair of Murdock 2,000-ohm type "A" head telephones. For the aerial system I used 100 feet of annunciator wire, wound two or three times around an apple tree as high as I could reach. The only insulation of the aerial was the cotton covering of the wire. As an earth connection I used three brass curtain rods driven in the ground to a depth of about three feet.

To my great surprise I heard not only Arlington and Cape Cod, but all the naval stations along the coast down to and including the station at Norfolk, Va., which is not very powerful in comparison with Arlington. As far as I am aware, this is near to a record-breaking accomplishment, considering the earth connection and the aerial employed.

H. C. MCINTYRE, *Maine.*

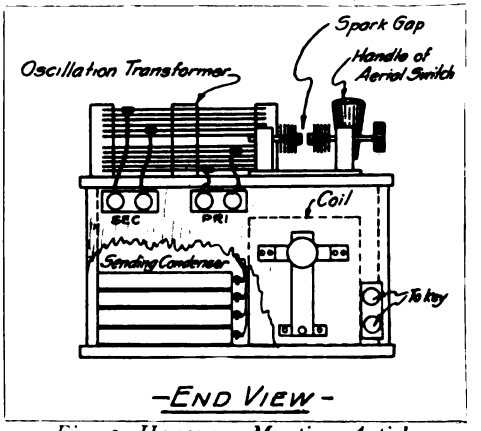


*Fig. 3, Honorary Mention Article, Francis R. Pray*

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## AN EXPLANATION

### Regarding a Cabinet Receiving Set of the Panel Type

The accompanying drawing will aid in making clear the diagram of connections illustrating my First Prize Article in the October (1915) issue of THE WIRELESS AGE. It should be understood that both the condenser switch and the detector switch are used in oblique positions only. When the detector switch is in the position indicated, the crystaline detector is connected to the secondary terminals of the receiving transformer; but when this switch is shifted to the opposite oblique position the vacuum valve detector is connected instead. Tracing out the diagram of connections for the condenser switch it will be seen at once that it may be connected either in series with the secondary winding to the receiving transformer or in shunt, as desired.

It is, of course, understood that when the crystalline detector is employed the switch to the filament of the valve is open. I trust that the details of construction for my apparatus are clear to your readers and I feel assured that with the corrected diagram they will experience no difficulty in obtaining results.

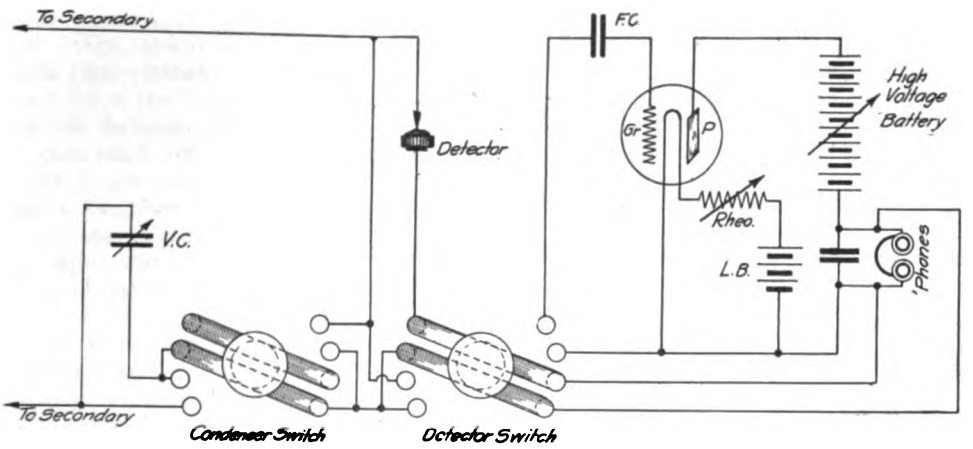
ARTHUR C. BURROWAY, *Ohio.*

## HONORARY MENTION

### A Testing Buzzer That Gives a High Pitched Note

The majority of amateurs have one or more of the old-fashioned type of bells or buzzers that are worthless for practicing the code or testing the crystal detector, because of the low, harsh note that they give, and the difficulty of adjustment. It is not advisable to use some of the small buzzers now procurable on the amateur market, because of the increased cost, and the fact that they do not retain their adjustment for an indefinite period. With a little patience, an old bell buzzer can be made over into an instrument that cannot be equalled by anything now on sale.

If it is an old bell that is to be used, the hammer arm should first be cut off near the contact point. Then solder the vibrator spring to the armature. Remove the lower magnet, the one nearest the binding post, and insert in its place a long screw, the end of which has been filed to a sharp point. The ordinary type of bell or buzzer already has a hole tapped which, through the medium of a small screw, holds the magnet in place. If the hole in the frame is not tapped, this may be done, or a nut may be soldered that will fit the screw to be used




— DIAGRAM OF CONNECTIONS —
FOR FIRST PRIZE ARTICLE IN OCTOBER "WIRELESS AGE"

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through the hole. A lock nut on the screw is necessary to keep it from loosening up when the bell is in operation.

By varying the tension of the screw on the spring and regulating the contact screw, any note from the original low to a high shrill pitch that is almost inaudible about the room, can be obtained. When by adjustment the desired note has been obtained, tighten up the lock nut, and suspend the entire buzzer by rubber bands. Do not screw it to a solid support, because the wood will vibrate with the buzzer and destroy the shrill note. If the buzzer is to be used for learning the code, about six volts should be employed for its operation. It will then make enough noise to be heard in any part of a large room.

If it is to be used for testing crystals, a flexible lead should be soldered to the contact point of the vibrator and connected to the earth connection of the receiving apparatus. This will produce a sound in the telephones equal in pitch and volume to that of the loudest signals.

D. SAMUEL MEYER, *Illinois.*

## More Light on Long Distance Work

Since I wrote my last article, which appeared in the February issue of THE WIRELESS AGE, I have collected additional data concerning amateur communication, which may be of interest to the readers of this magazine.

My station was heard and copied in Yonkers, N. Y., by 2-IB (a distance of 1,000 miles), on January 19, and at that time it was raining in Chicago. I used a transmitting power input of 1 k. w., and the station at 2-IB employed a single vacuum valve bulb.

Regarding daylight work: I communicate practically every afternoon with 9-KV and 9-MA, located in Salem, Wis., (70 miles away). Station 9-KV uses a 3-inch coil and Station 9-MA uses a 2-inch spark coil. These stations employ oil condensers, oscillation transformers and a series condenser to reduce their wave to 200 meters.

With respect to the character of my own wave, it is exactly 200 meters, with a decrement of .2 and I obtain an antenna current of six amperes. My friend, who operates the station 9-EV in Chicago, using a 1 k. w. transmitter, has also been heard by 2-IB. This apparatus sets up 4¼ amperes in the antenna circuit, and was tuned exactly to 200 meters by the United States radio inspector.

Station 9-EV, has communicated with 8-NH, of St. Mary's, Ohio, at four o'clock in the afternoon, and I have worked with an amateur at Lawrence, Kansas, at three o'clock in the afternoon. His station is approximately 500 miles distant from mine.

I note the statement that, on account of close coupling, a double wave may be emitted. I use a coupling of 3 inches between the primary and secondary windings, while station 9-EV uses one of 6 inches; therefore, I do not think the double wave theory feasible, especially in the latter case.

There are many amateurs in the country about us obtaining the same results. As a matter of fact, I have a list of nearly seventy-five amateurs, over 200 miles distant, with whom I could communicate, or whom I have heard. If this kind of work is "freak" work, it is a pretty successful "freak" and can almost be considered as normal.

R. H. E. MATHEWS, *Illinois.*

## Experience in the Middle West

I read in your comments on the long distance work performed by R. H. E. Mathews, in the February issue of THE WIRELESS AGE, that you wish to hear from other amateurs regarding the results obtained on the 200-meter wave in the Middle West. I have obtained results equal to those secured by Mr. Mathews during the winter, using two vacuum valve detectors connected in cascade.

Within the past two years, I have employed more than a dozen different vacuum valve bulbs, and I find occasionally that a single bulb with an ordinary hook-

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up is as good or often better than the usual cascade connection. This may account for Mr. Mathews' excellent results, but it would hardly explain those obtained by his friend using the galena detector. I might mention in this connection that I have a friend in Owatonna, who obtains results almost as good as I secured with the galena detector.

I have no difficulty in receiving signals from stations in the Twin City, sixty miles away, with 200-meter sets in the daytime. I have heard 200-meter stations at distances of 200 and 300 miles in the night time, but have had somewhat better results on slightly longer waves, some of them a little in excess of 200 meters. For example, I heard 5-BJ, which is now known as 5-ZC, at least one foot from the head telephone. I receive 9-LO fully as well, and have heard 7-BD, Lewiston, Mont., rather strongly.

To illustrate the conditions in this vicinity, Station 9-ZM, Minneapolis, Minn., using a wave-length of 420 meters, and a power input of ½ k. w., can reach Grand Forks, N. D., a distance of 300 miles, any fair evening in the winter time. Station 9-YG, the Agricultural College at Fargo, N. D., has been heard well at Station 8-ZW, Wheeling, W. Va. From the results obtained by other amateurs, I believe that conditions are much better in the West than in the East.

The fact that the before mentioned stations generally use sensitive receiving sets should be taken into consideration.

Eben R. Dennis, *Minnesota.*

### From an Eastern Amateur

In view of R. H. E. Mathews' statement, and the editor's note appearing in the February issue of The Wireless Age, an Eastern amateur's experience with 200-meter waves may be of interest. Using a single X grade vacuum valve, with no amplifier attachment, a large loose coupler, and a single wire inverted "L" aerial, 330 feet in length and 40 feet in height, with a very small variable condenser in series with the aerial (an admittedly inefficient arrangement for short waves), I have copied signals from scores of amateur stations on a 200-meter wave in Michigan, Illinois, Indiana, Ohio, West Virginia, North Carolina, and nearer.

I have heard 200-meter stations 700 miles distant while holding the telephones over twelve inches from my ears, and I have read 8-NA and some others in Ohio with the aerial disconnected entirely from my set. Furthermore, I have copied amateur stations in Iowa, Florida and North Dakota. Station 9-GN's signals come in very good with an ordinary receiving hook-up. Time and again I have noted that 2-KK, and other amateurs about 300 miles distant come in much stronger than NAH (Brooklyn Navy Yard), and other long wave government and commercial stations in New York and nearer.

I have attributed the long distance record to the efficiency that this particular vacuum valve bulb has shown; but the facts mentioned in the foregoing paragraph cannot be explained thus.

Allan E. Dudley, *Massachusetts.*

*Editor's Note.*—We have no data regarding the design of Mr. Dudley's tuner, but we are inclined to believe that if it had the proper values of inductance for the reception of signals from the Brooklyn Navy Yard, louder signals would be obtained than from amateur stations using the 200-meter wave. In addition it should be taken into consideration that the Brooklyn station is badly located for long distance transmission and cannot be expected to cover the range of a similar set more favorably located. An error in many amateur receiving tuners used with a vacuum valve detector is that on the longer range of wave-lengths a condenser of considerable capacity is connected in shunt to the secondary winding. This condenser limits the voltage which may be applied to the grid of the vacuum valve and in consequence stations using the longer waves are not well heard. The dimensions of the secondary winding of the receiving tuner should be such that for all ranges of wave-lengths a very small condenser in shunt to the secondary winding is in use. Its maximum value in no case need exceed .0005 of a microfarad and better results will be obtained if it is kept as low as .0002 of a microfarad.

We should like to learn from Mr. Mathews and Mr. Dudley whether the results they report can be obtained at night during the hot summer months. We doubt very much if they could carry on such communication throughout the twelve months of the year continuously, although the fact that they are able to do so occasionally is of great interest to the amateur experimenter. It should stimulate interest in amateur communication to

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know that exceptional distances with small sets operating on the 200-meter wave can be obtained, and we rather fear that the Post Office Department of the United States will be the greatest sufferer, for if an individual can communicate by wireless for a distance of several hundred miles, there is no need of waiting twenty-four hours for a written message.

It has been known for years in commercial wireless telegraphy that an apparatus capable of transmitting 500 miles continuously in broad daylight will often cover from three to six times that distance during the night hours, throughout the favorable months of the year, which in the eastern part of the United States seem to occur between September and May. However, we advise our correspondents that in order to maintain continuous communication throughout the twenty-four hours of the day and throughout the twelve months of the year over a distance of seven hundred miles, they would require a good 50 k.w. transmitting set constructed to give a high percentage of efficiency. Reports, such as the foregoing, are of interest to all radio experimenters.—TECHNICAL EDITOR.

## A WATCH FOB FOR N. A. W. A. MEMBERS

**By Leighland Parker**

Members of the National Amateur Wireless Association will be interested to learn that the Association buttons can be made into attractive watch fobs. A large number of the members carry the pins in the button holes on the lapels of their coats, but some have school or class insignia which they are at a loss to find suitable wearing places for. To the latter class the pin-watch-fob device will appeal particularly.

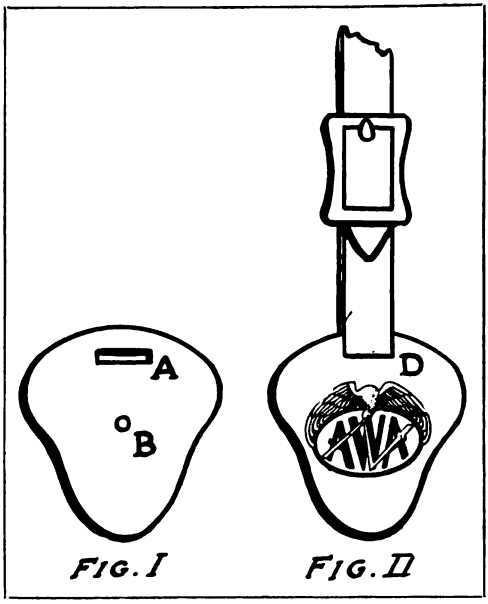



FIG. I FIG. II

Directions for making the watch fob follow:

Take the back of an old leather fob, or, if none is at hand, cut one out with a knife. Having obtained a leather back in some form, such as is shown in Fig. 1, cut a hole, A, about ⅛ of an inch from the top, of sufficient size to allow the strap used in attaching the fob to the watch, to pass through. Then, at some point, B, preferably near the center of the figure, punch a hole large enough to accommodate the screw on the back of the button. The fob may be finished and polished by using either black or tan shoe polish. The strap should then be placed through the slot (see D, Fig. 2). The button is put on by placing the screw on its back through the hole already punched and screwing on the nut. When complete the fob appears as shown in Fig. 2.

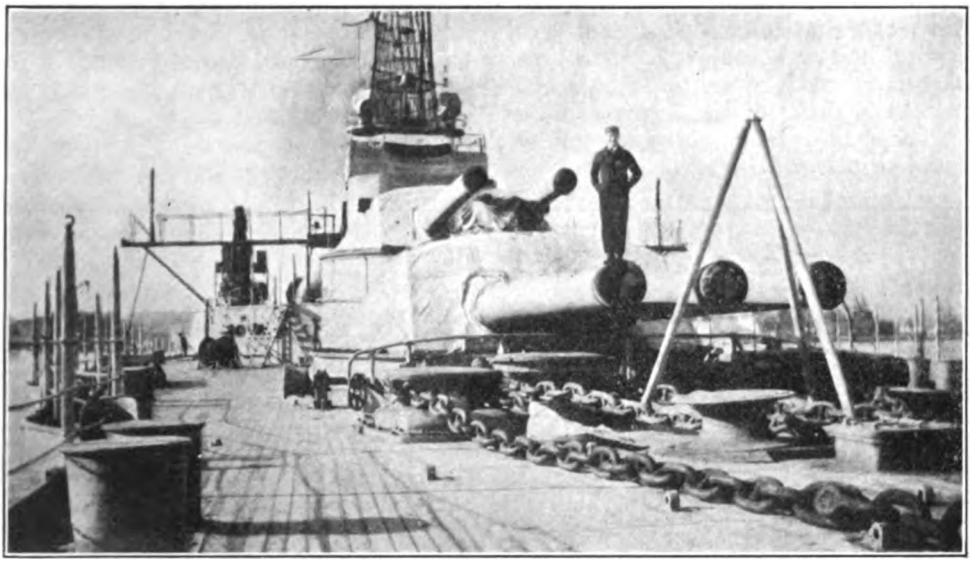
## PLANNING TRENTON'S THIRD LINE OF DEFENCE

Members of the Washington Radio Club, of Trenton, N. J., which organization has received a charter from the National Amateur Wireless Association, are planning to form a local branch of the Junior American Guard. The Guard, as has been announced in THE WIRELESS AGE, has affiliated with the National Amateur Wireless Association. Boys ambitious to become members of the Guard should communicate with Martin K. Pillbury, Washington Market Building, Trenton.

Excellent progress in the study of wireless telegraphy among the members of the Boys' Club, of Malden, Mass., is reported. Addresses by members of the club on phases of wireless telegraphy and electricity in which they are most interested are features of the meetings of the organization. The officers of the club are as follows: President, Joseph Muldoon; vice-president, Joseph Robbins; secretary, Charles Robinson; treasurer, Myles Garigan.

# The Oklahoma's Trial Trip

**By Willard S. Wilson**



*The forward battery of five fourteen-inch guns on the Oklahoma*

ALTHOUGH a wireless operator on a battleship is not, strictly speaking, one of the men behind the guns, he is always in the center of the activities. My experience in the wireless cabin of the United States superdreadnought Oklahoma during her recent trial trip induced the foregoing opinion.

The battleship left Camden, New Jersey, on January 5 and steamed down the Delaware River to Deepwater Point where, as she was drawing almost twenty-nine feet of water, it was decided to wait a day for the high tide. Then we continued our trip, and on the morning of January 7, the Oklahoma pointed her nose up the East River. She steamed under the Manhattan Bridge to the accompaniment of clicks from the cameras of the motion picture operators on the structure, and made her way into the Brooklyn Navy Yard. There she remained for four days to be inspected and painted.

When the vessel steamed out of New York harbor at the end of that time she was bound for the official trial course of the Government, off Rockland, Me. This, I found, was one mile in length and was marked by buoys. It has the advantage of a considerable depth of water.

The Oklahoma steamed over the course several times, her highest speed being 21.47 knots an hour. This record excelled that of her sister ship, the Nevada.

After the full-speed tests were completed the ship was required to make a ten-knot, twelve-hour run, a fifteen-knot, twelve-hour run, and a twenty-and-one-half knot, twelve-hour run. These trials were made between Rockland and Boston for the purpose of ascertaining how much fuel oil was burned and how much water was used to produce the desired speed. Other information, such as the revolutions a



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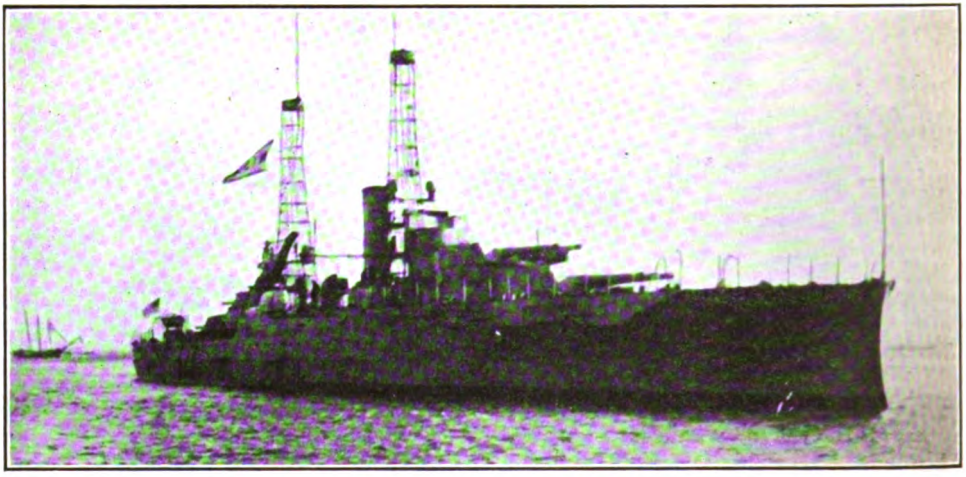
minute of the propellers during the different speeds, was also obtained in this manner. At full speed the propellers reached a speed of 130 revolutions a minute and little vibration resulted.

The final tests were made outside the Delaware Capes on the return trip. The first consisted of reversing the engines to full speed astern while the ship was going full speed ahead to determine just how long it took to bring her to a stop. The next and final tests was the making of the figure eight at full speed in order to show how quickly the ship could be turned about and navigated in an opposite direction from that in which she had been steaming. It was also a severe test for the steering gear.

The wireless apparatus was idle but little of the time during the trip. "Press" was sent out by Cape Cod, Miami, Cape Hatteras and other Marconi land stations and published daily in The Oklahoma News. All of the stations came in strong enough to be copied on a typewriter. The set on the Oklahoma consisted of a ½ k. w. Marconi panel transmitter and a receiver, type 103.



*The Oklahoma anchored in Boston harbor after her trial trip*

## THE AMERICAN MARCONI COMPANY'S ANNUAL REPORT

*(Continued from page 453)*

Referring to government ownership, the report says in part:

"If the ships of the sea are to develop among themselves and to the shore, universal intelligible communication, which is undoubtedly within the possibilities of radio development, a government department, it will be admitted, can hardly be qualified to insist on the disciplining of an operator in a foreign ship who may be lax in duty or deficient in qualifications. There are daily possibilities here for the development of unpleasant and embarrassing international complications. Private enterprise is already rapidly working out this problem through the means of equipment contracts, binding ships to employ only operators possessing standardized qualifications as to langauge, etc., and amenable to a central discipline as to the observance of certain mechanical and operating regulations. The abandonment of the ideal of the universal intelligibility of wireless is to abandon its future development; but such abandonment is inherent in a government monopoly of the art, as can readily be seen from the limitations of the jurisdiction of a government, and the cumbersomeness of its international representation."

The report is signed by Hon. John W. Griggs, president of the company. Annexed to it is a seventeen years' record of the marine disasters in which wireless figured, extending over a period from 1899 to 1916.

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# How to Conduct a Radio Club

## The Installation of Stations

*(Specially Prepared for the National Amateur Wireless Association)*

**By Elmer E. Bucher**

**ARTICLE XXII**

MANY amateurs follow the practice of commercial companies by mounting their apparatus compactly on an insulating panel, but others prefer to have the various parts of the equipment placed so that they are easily accessible for repair or adjustment. For those who follow the latter plan a suggested lay-out for the apparatus of a station is shown in the accompanying drawing, wherein particular care has been taken to place the oscillation transformer, spark gap and condenser near to one another, thus allowing short connecting leads—a self-evident requirement for a 200-meter set. In addition, simplicity of installation was kept in view to avoid the usual bungling and criss-crossing of circuits often observed in amateur equipments.

The operating table is placed about 32 inches from the floor and is approximately 30 inches in width. It may be from 6 to 8 feet in length, according to the space available, and is, of course, supported at intervals by 2-inch by 4-inch uprights.

### REQUIREMENTS OF THE TRANSFORMER

Under the table and to the left in the drawing is placed the high potential transformer, which, for the requirements of the amateur station, must not exceed the primary input of 1 k.w. with a secondary potential varying between 12,000 and 20,000 volts. The transformer shown in the drawing is of the open core type, and is of more suitable design for amateur installations than an instrument of the closed core type, unless the latter is constructed so that it has a certain amount of magnetic leakage. The secondary terminals of the transformer are insulated by corrugated hard rubber bushings, B-1, capable of withstanding an applied potential of 20,000 volts without leakage. A safety gap is provided to protect the windings of the transformer and the condenser in the event that the spark gap proper is abnormally lengthened. It merely consists of 2 discharge electrodes connected to the secondary terminals of the transformer and separated sufficiently to prevent discharge when the regular spark gap is in use.

### The High Potential Condenser

The condenser rack is mounted on the top of the operating table and is insulated from it by the corrugated porcelain or electrose legs, B-3. For operation at the wave-length of 200 meters, the unit may consist of about sixteen plates of glass, with an average thickness of one-eighth of an inch, the other dimensions being 14 inches by 14 inches, covered with tinfoil 12 inches by 12 inches. The plates are divided into two 8-inch banks, connected in parallel, and two banks finally connected in series. The leads from the secondary winding of the transformer are led up through the table through the insulating bushings, B-2, and are attached to the binding posts, B-4, which are mounted on hard rubber slabs on the edge of the condenser rack. No. 14 insulated D. B. R. C. wire will easily handle the output of the secondary winding, but a neater job will be effected if 3/16-inch copper tubing is employed, as it may be bent at right angles, wherever necessary, and is self-supporting when properly attached to the binding posts, B-1.

The connecting tabs of tinfoil from the plates of the condenser are attached to the binding posts, B-4. To afford



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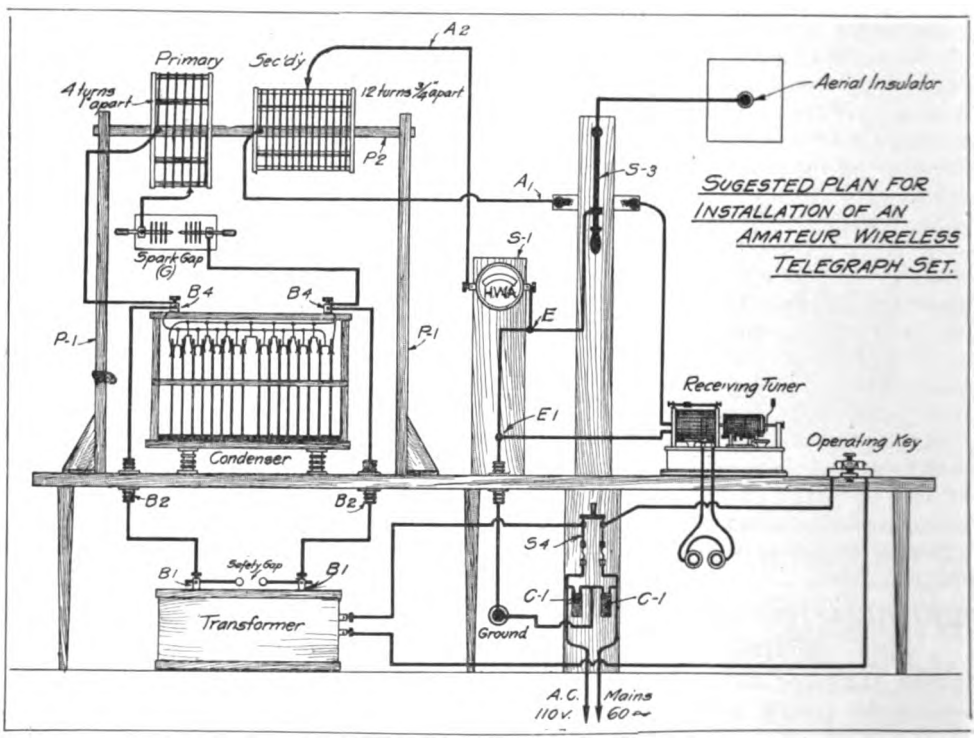
better protection for the plates the entire unit comprising the wooden rack and the plates may be immersed in a metal or porcelain tank filled with a good grade of insulating oil. However, this design often is not found suitable, as it is difficult, even with the best compound, to keep the tinfoil on the plates when they are thus immersed, unless they are stacked up and closely bound together with insulating tape.

To keep the connecting leads from the condenser and spark gap to the primary winding of the oscillation transformer at a minimum length, the oscillation transformer is mounted on a wooden rack supported by the pillars, P-1, with the cross rod, P-2. The primary winding is permanently fixed to this rod, but the secondary winding may be slid backward and forward, thus allowing a variation of the coupling.

The primary winding has about four turns of 3/16-inch copper tubing, with the turns spaced 1 inch apart. The winding may be from 8 to 10 inches in diameter. The secondary coil contains from eight to ten turns, spaced ¼ of an inch apart, and may have the same size of tubing. To keep the emitted wave pure and within the limits of the law, it generally is not necessary to have the secondary winding inside of the primary winding; usually there is an air space intervening of from 2 to 3 inches at the most effective degree of coupling. It is quite essential that both the primary and secondary turns be well insulated and, in consequence, the supports of either must be made up of some good insulating material, such as a high grade of hard rubber, porcelain, bakelite or micarta.




A spark gap, G, is placed between the condenser and oscillation transformer and may take one of several designs. It is the custom at the more advanced amateur station to use an instrument of the non-synchronous type, which usually consists of an insulating disc, 6 to 8 inches in diameter, with eight discharge electrodes, mounted on

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the shaft of a motor having a speed of 2,400 revolutions a minute. At stations lacking a source of direct current the terminals of the motor must be connected to the A. C. power mains, and since the majority of such motors have a synchronous speed of 1,800 revolutions a minute, the diameter of the disc may be slightly increased and fitted with from ten to fourteen electrodes.

### How to Start the Motor

The terminals of the motor are connected to the top terminals of the 50-ampere power switch by means of which it can be started and stopped. Of course various methods can be devised for starting the motor, one being to fit the antenna switch with an extra set of contacts, so that when it is thrown into transmitting position, the circuit to the motor is closed. For the sake of simplicity, however, the beginner is advised to employ the method shown in the drawing. Owing to the noise from the gap, it is desirable to enclose it in a suitable muffling box, which may be constructed after various designs, but whatever the construction, particular care should be taken to allow short connecting leads to the condenser and oscillation transformer. It is obvious that the terminals of the spark gap must be well insulated from the containing box and also from the wall upon which the box is mounted. The gap can be effectively cooled by drilling two holes in the side of the box and fitting the rotor with a cooling fan. The burned gases are thus removed and a fresh supply of air constantly fed. This will tend to maintain the insulating qualities of the gap supports inside the box and prevent their burning out.

The antenna switch, S-3, is of the simplest possible design, merely consisting of a single blade, double-throw switch, which, when thrown to the left, connects the secondary winding of the oscillation transformer to the antenna and to the right makes contact with the connection to the receiving tuner. In the center position the blade of this switch connects the antenna to the earth lead of the transmitting apparatus at the point, E, making an efficient lightning switch. To comply with the underwriters' regulations, this switch must be capable of carrying a current of 100 amperes and, from the standpoint of wireless apparatus requirements, all studs should be separated at least 6 inches to prevent the direct discharge of antenna potentials over the insulating base. It is, of course, evident that the lever and studs of the switch must be mounted on a good insulating material, which in no case should be of slate. A good grade of hard rubber, bakelite or micarta will in this case fulfil the requirements.

A connection is extended from the aerial wires to the lever of the change-over switch through the insulator, I, which is a hard rubber tube with walls ⅜ of an inch in thickness, with a ¼-inch hole. A brass rod is threaded at both ends and fitted with nuts and connecting lugs, passed through the hole and firmly fastened in place. As an alternative a hole can be drilled through a window pane and a brass rod passed through the first named, but the incoming leads of the aerial must then be well backstayed to remove the strain from the glass.

The right hand stud of the antenna change-over switch is connected to the antenna post of the receiving tuner and the earth connection from the latter makes contact at the point, E-1, to the wire to which the transmitting apparatus ground lead is attached. With this type of switch in use it is intended that the receiving tuner be fitted with a shunt switch to protect the detector from the local oscillations of the transmitter during the period of transmission.

### The Transmitting Key

The transmitting key is mounted immediately to the right of the tuner, being placed far enough from the edge of the table to allow the sending operator's elbow to rest on the ledge. It should be capable of carrying a current of 10 amperes without arcing. These keys are generally fitted with platinum or silver contacts.

The hot wire ammeter may be connected either in the aerial lead, A-1, or in the earth lead, A-2. If connected in the former, it should be mounted on an

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insulating stand made of a sheet of hard rubber or other suitable material of the correct dimensions to support the meter. The base should be insulated from the wall by hard rubber legs. It is not entirely necessary that this meter be mounted on an insulating support when connected in series with the earth lead, but it is a requirement of the underwriters in many cities that this be done, regardless of the point at which it is connected. It should be noted in the diagram that the meter is mounted on an upright piece of 1-inch wood, which is fastened to the table by means of iron brackets in the rear.

The correct dimensions for an amateur's aerial to be operated at a wavelength of 200 meters is a matter of great importance, but the subject can be covered in a few words. Under favorable conditions it is of no advantage to use more than four wires. However, an exception is made at stations where the flat top portion is limited in respect to the length. Here it may be of value to have many wires in parallel in order that the capacity of the antenna system may be increased. For an aerial composed of four wires, spaced 2 feet apart, the flat top portion cannot exceed 60 feet in length by 40 feet in height. If of the "T" type, the flat top portion may be 120 to 130 feet in length and from 40 to 60 feet in height, providing the incoming leads are not of excessive length. It is, of course, understood that an aerial having lesser dimensions is suitable for the purpose.

### The Earth Connection

For amateur stations located in isolated districts where there are no water mains or steam pipes for connection to the earth, a satisfactory earth connection can be made from 250 square feet of galvanized sheet iron or copper, laid in moist earth, let us say, to a depth of from 5 to 8 feet. A connection of copper strip 2 inches in width should be firmly attached and soldered to the plates and led directly to the oscillation transformer of the transmitting apparatus. Additional contact can be made with the moist earth by driving several lengths of galvanized iron pipe with a sledge hammer to a depth of 8 or 10 feet under the copper plates previously mentioned. Surface grounds have also been effectively employed at amateur stations. These consist of several copper wires laid directly under the antenna system, or galvanized wire netting. This is of the kind used in country places for fencing.

### Gas Mains Not Desirable Connection

Connection should not be made to the gas mains of any house, as in many cities the gas mains are fitted with an insulating bushing near to the meter, which effectively disconnects the entire system from the earth. At every station where it is possible to do so, a piece of copper ribbon, let us say 2 inches in width, or a piece of heavily insulated No. 2 or No. 4 D. B. R. C. wire, should be attached to the water main on the street side of the house meter. In many homes and apartment houses it is not possible to do this, and, therefore, connection must be made to the steam pipes, to the water mains inside the house, or to the steel frame of the building, if such exists.

The underwriters require in some localities that the earth lead from the apparatus be thoroughly insulated up to the point where actual connection to the earth capacity is made; hence in many installations it is necessary to construct special insulators to hold the copper ribbon away from the structure to which it is attached.

The switch, S-4, breaks the main A. C. line and is of 50 amperes capacity. It is fitted with fuses of the enclosed type and connection from the main should be attached to the bottom side of the fuses. The connections from the switch to the transformer and key are of No. 12 lead covered cable, securely strapped in place by means of small brass pipe straps.

It will be noted from the drawing that the switch is mounted on a piece of timber attached to the edge of the table and fastened to the floor. In order to eliminate all danger of fire the underwriters usually require that this

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switch be mounted in a metallic box or on an asbestos base.

### Protective Devices

To remove from the primary power circuit destructive potentials, due to the electro-static influence of a wireless transmitter, it is customary to supply protective devices to neutralize these potentials and lead them to earth. A popular form at many amateur stations is the use of two one microfarad condensers connected in one series and grounded at the middle point, as indicated at C-1 in the drawing. A set of these can be connected to the power mains directly underneath the 50-ampere switch and an additional set placed in the basement of the house near to the power meter. The earth connection from these condensers can be attached to the same earth lead used for the transmitting apparatus proper.

In selecting a receiving tuner the builder should clearly decide for himself the range of wave-length over which he desires his apparatus to respond and in this matter he should be guided by the local conditions in his vicinity. For example, if the apparatus is only to be employed for amateur communication at a wave-length of 200 meters, the tuner should be built specifically for the purpose, as it will then give the highest possible degree of efficiency. For the general run of amateur aerials and for use with the 200-meter wave, it is not necessary for the primary winding of this tuner to be more than 3 inches in length by 3¼ inches in diameter, wound with about eighty turns of No. 28 D. S. C. wire. The secondary winding may be 2¾ inches in diameter by about 2 inches in length, wound with sixty turns of No. 30 D. S. C. wire. The secondary winding shunted by a small condenser will respond to wave-lengths somewhat in excess of 200 meters. Of course, for the reception of signals from high-power commercial stations, the tuner must have increased dimensions. Complete information concerning this subject is contained in the book, "How to Conduct a Radio Club."

The receiving telephones for the amateur station generally have a resistance varying from 2,000 to 3,000 ohms. A small hook should be screwed in the side of the operating table for holding the telephones when the station is not in operation.

To resume numerically the values for the set described in the foregoing the high potential transformer should have a primary rating of ¼ to 1 k.w., with the winding constructed for a potential of 110 volts. The secondary potential may vary between 12,000 and 20,000 volts. The high potential condenser should have a capacitance varying between .008 and .01 of a microfarad, while the primary winding of the oscillation transformer may have a maximum value of inductance of approximately 5,000 centimeters. The secondary winding of the oscillation transformer should total about 10,000 centimeters of inductance. The aerial hot wire ammeter has a maximum scale reading of 6 amperes and the antenna change-over switch a current-carrying capacity of at least 100 amperes. The primary power switch has a current-carrying capacity of 50 amperes and is fitted with 15-ampere fuses. The transmitting key must be capable of withstanding a current of about 10 amperes and should be fitted with either silver or platinum contacts. For amateur purposes the range of the receiving tuner need not exceed 250 meters, but for the reception of signals from commercial stations it should be adjustable to wave-lengths of 3,000 meters.

### Importance of Correct Design

The writer does not maintain that the plan shown in the drawing is applicable to all amateur stations as local conditions in many cases will prevent it from being carried out. But the suggestions given may be of help to many who are not fully informed on the subject. Every amateur should thoroughly understand that the apparatus must be correctly designed and carefully mounted in order that the full range may be obtained.

*(To be continued)*

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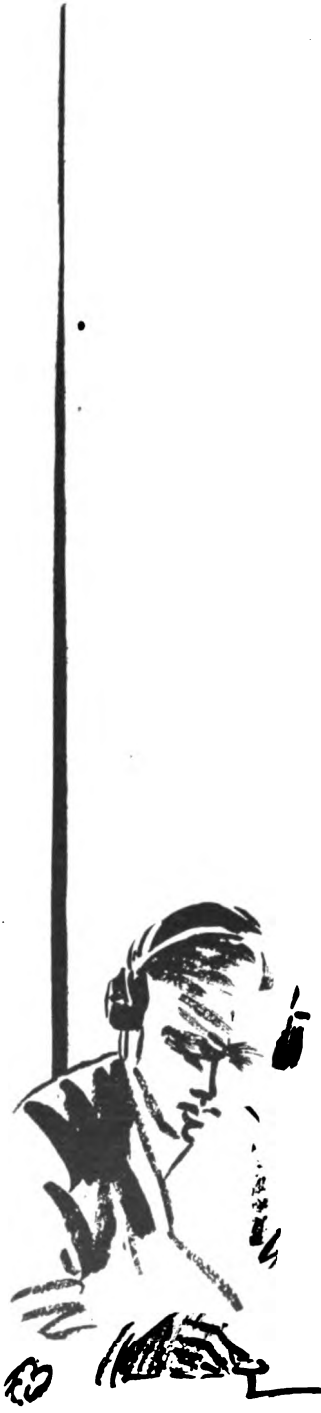
# A Marconigram

By

Charles Poole Cleaves

Let us labor on with a right good cheer,
You at your post and I at mine.
Fling me a thought as I labor here;
Hark, O friend, to the countersign.
O, what is space but pulsing air
And what is the silence but the cheer
The toil-winged moments lift and bear
Across the ranges, far or near?

Whatever the morning cloud may spill,
Fretting my day, I know that you
Are working on with a cheerful will
Whatever the task you have to do.
And you—do you know that never unknown,
However unseen, is your work divine?
So I will to work, though I work alone;
As you at your post, so I at mine.



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# Wireless in the Movies

By Benjamin Baker

*The naval lieutenant saves his country from the foreign plotters: Calling the fleet by wireless*

**Radio Sets and Their Operators Vital Necessities in the Staging and Plot Actions of the Silent Drama. Using the Marconigram to Bring About a Climax.**

"IT'S a new sensation. It's a tingle, I tell you, it's a thrill."

The "exhibitor" in the lobby of the big Broadway playhouse looked impressed and impressive. He beckoned to me, and we entered the auditorium. The lighted screen within the proscenium arch was picturing a silent drama.

"There's been a flood of bookings for this," whispered the exhibitor. "They all want the first run."

The story the screen was telling was that of a pleasure yacht which had just struck a mine in midocean. We saw the rush to the lifeboats. We saw the craft abandoned—no, someone had been left aboard. It was a young woman, who had been imprisoned in the wireless room by the force of the explosion. There seemed to be no escape for her. The yacht began to sink, and water to pour through the porthole. The fair prisoner ran to the wireless apparatus and began to send out the S O S.

The yacht continued to sink and the water to rise. The girl still frantically signaled, so long as she was able. The water reached her waist, her shoulders, her chin. The wireless instruments had long been submerged. But had the signals been picked up?

Yes, the "flash-back" showed an American cruiser under full steam. A U. S. N. lieutenant put off with a boat's crew and arrived in time to rescue his sweetheart, just as the yacht went down.

It is the dramatic climax of a motion picture play, at this moment one of the big runs of the movie world.

It was, as my enthusiastic friend the exhibitor said, a new sensation. One could sense it in the gasping suspense of the audience.

Wireless telegraphy, in its many uses and phases, has added a new element of interest to the motion picture drama. A wireless outfit is now an important stage accessory; in fact, it is indispensable in every property room. Marconi operators are frequently engaged by moving picture studios to lend the added realism of

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skill and technical training to the scene.

The motion picture play referred to is what is known as a "massive" production. There is a scene in a foundry, showing the casting of a gun; the bursting of one of the huge coast defense weapons while it is being tested; the sinking of a yacht at sea by contact with a floating mine; the scenes on the deck of a United States battleship. But the grand climacteric arrives with the S O S call, and the spectator is spellbound by the scene in the wireless room.

Of course, the art of the pantomimist must be called upon to interpret the dramatic possibilities of wireless, but even the mere addition of a wireless outfit to a scene impresses the beholder with an instinctive sense of the imminence of an important event. It is an elemental rule of stage psychology that woman should characterize the emotional climax. It taxes the skill of the scenario writer to give a quick, plausible explanation of the knowledge his heroine possesses of wireless telegraphy.

It is interesting to see how this obstacle is overcome. In the "tingle" I am writing about the heroine is the daughter of a wealthy ironmaster. One of the opening scenes reveals that she is an enthusiastic wireless amateur, and has had her father install a radio set in their home. Here she is seen practising, and her sweetheart, the lieutenant, who is an expert in the craft, coaches her in the use of the apparatus. This instruction is shown to stand her in good stead when she sends the S O S on the sinking yacht, and lends verisimilitude to the means she adopts in saving her life.

But young women can't all be supposed to have wealthy fathers, possess wireless equipments and be enthusiastic amateurs—no, not even in motion picture plays. In another production in which wireless is a feature, the young heroine is a professional wireless operator at Martinique. In this capacity, she saves a steamship during the Mt. Pelee eruption. As a survivor of the disaster, she is adopted by a wealthy woman, whose son, Neal, is in the Naval Training School at Newport. Together they travel to Newport, the girl carrying with her a packet containing a map showing the location of a lost island and its treasure trove. It is the stereotyped Stevenson romance, of course, with up-to-date trimmings, but the conventionality of the plot is effaced by the swift, vivid, clear-cut action of the screen.

We see the girl and her friends sail for the lost island and the buried treasure aboard the steamship Coronado, while the three R. L. Stevenson villains who are pursuing her, take passage as members of the crew. The Treasure Islanders concoct the inevitable mutiny. Now our heroine's professional training comes into play. In the midst of wild alarm, she flies to the wireless room and sends out the wireless call for help. It is picked up promptly. The gunboat Jackson is cruising in southern waters, and Neal and his crew effect a thrilling and timely rescue.

But wireless is not the exclusive prerogative of the Treasure Island idyll and the S O S romance. It is used as effectively in a modern society motion picture. This story deals with the problem of a very young woman, used to every luxury, who is confronted with the question of choosing the man of her heart or the man who can give her the life of ease and abundance to which she has become accustomed.

Mme. Petrova in the role of a multimillionaire's daughter meets a young officer, with whom she falls deeply in love. Another suitor has an immense fortune. The eternal triangle develops on shipboard, during a voyage from the Philippines. The wireless operator aboard the liner picks up a message from a Pacific coast station, announcing the financial ruin of the heroine's father. The dream of love in a cottage vanishes, and the spoiled young woman eventually weds her wealthy suitor. The wireless has interrupted the romance only temporarily, however, and the ending of the play is as it should be, for tragedies are rare in the movies.

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*The wireless call for help. The mutineers have seized the ship*

The other night I witnessed a "preparedness" movie. Suddenly, not far from me, a feminine voice was raised in curious wonder: "Can you do all those things with wireless?"

The question was a poser. I shall let the reader reach his own conclusions. Wireless is actually the *deus ex machina* of the performance. The possibilities, and one is tempted to say, the impossibilities of the Hertzian wave, are here utilized to the limit.

The motion picture play shows us the operations of two secret agents working for the conquest of the nation by a foreign power. Colonies of hyphenates are in wireless communication with a great trans-Atlantic wireless station in the heart of the Maine woods, which, in turn, communicates with the foreign power. The wireless villains have a game preserve near Newport, in which is *their* wireless station and a privately installed battery, commanding the city's defenses. This is going some, even for wireless. But wait.

The wireless villains found a peace society, in order to retard preparedness. They induce an admiral's granddaughter, who has a congenital terror of war, to join their society. In fact, the too peaceful heroine prefers one of the wireless plotters to a patriotic lieutenant. This hero, however, comes into possession of the plans and model of an aerial torpedo, "controlled by wireless." The plotters overpower the lieutenant in his laboratory, abduct him and his model and confine him in their wireless station.

We now "cut-back" to the admiral's granddaughter, who has been persuaded that she can save the country from a dreadful war if she steals the plans of the aerial torpedo. This she does, but finally divining the true purpose of the sham peace advocate, she kills him with her father's sword, and becomes transformed into a preparedness patriot.



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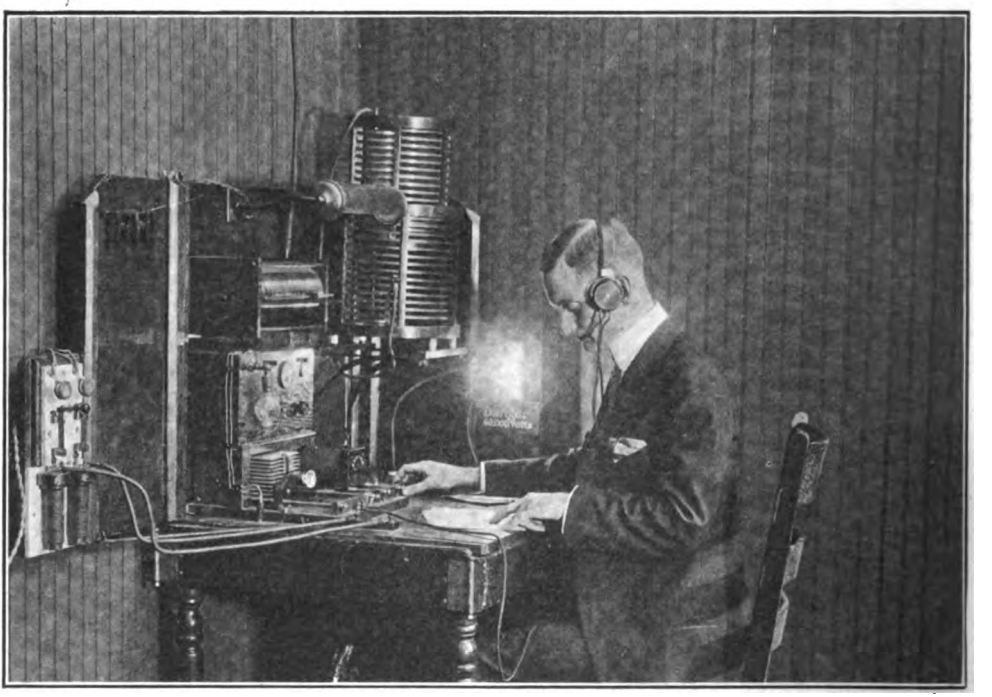
There is a "flash-back" to the imprisoned lieutenant, who, although bound, manages to electrocute the wireless operator in the secret station by short-circuiting the high tension current which enters the station. In the meantime Newport is attacked. The lieutenant frees himself, repairs the wireless and sends word to the fleet which is far down the coast. The nation is saved.

It must be admitted, the scenes of the play are stupendous. For more than six months the players, a corps of camera men, scenic artists, carpenters and hordes of "supers" were kept at work at Newport in its making. There was a continuous marching and countermarching of troops, the rattle of artillery, the working of wireless stations, the whirl of aeroplane propellers, and the boom of battleship guns. In order to bring realism to the scenes of the navy at its destructive work of bombardment, a ship was bought and sent to sea, and with it as a target, the battleship Utah, and the U. S. S. Patterson and U. S. S. Yankton played for the camera and their big guns soon sent the "Movie," as the craft was termed, to the bottom of the sea.

But it is in the sea tale, on the flowing tide, with the wind that follows fast, that wireless is utilized to the best advantage. In another motion picture play, Hamilton Revelle impersonates a radio expert, in the role of "one of the ablest men in the British Secret Service." Here wireless is adapted to a plot of deep intrigue and adventure. The Secret Service man is discredited through the theft of a document by his enemy. In his search for "File 117," he disguises himself and gets aboard a yacht bound for Labrador. The vessel is struck by an iceberg, and the Secret Service man saves all on board by despatching a wireless call as the yacht goes down.



*The wireless ends a dream of love in a cottage. It tells of the bankruptcy of the wealthy heroine's father*

The pictures taken for this film were obtained from a yacht actually sunk by the motion picture producers, at the expense of many thousand dollars. While the rest of the party are taken off in lifeboats, the Secret Service man and the heroine save themselves on a raft, which lands them at an island

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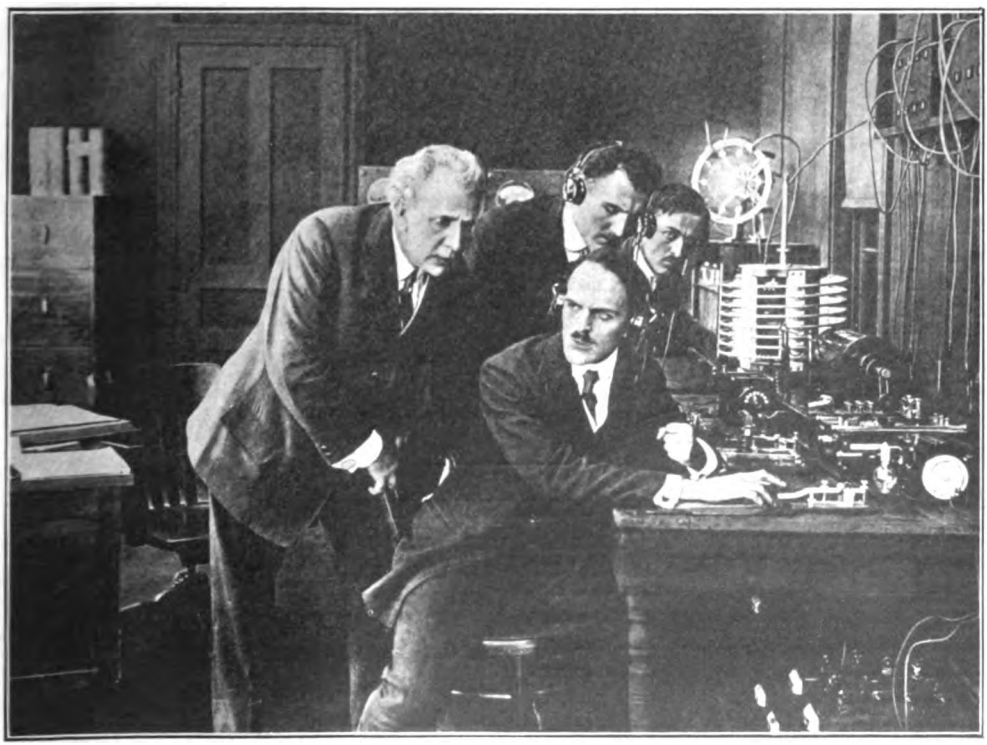
near the coast. Here they are marooned for some time, during which the radio expert learns that his fair companion has the missing document in her possession. When eventually rescued, they send a wireless to England, announcing the recovery of "File 117."

A novel use of the wireless is introduced in a feature play which tells the story of a wild college youth disowned by his father, who rises from his chosen calling of a sailor to the head of a fishing industry, afterwards to conquer Wall street, the little crooked lane with a river at one end and a graveyard at the other. It is a "fighting play." During a terrific storm the men are ordered aloft and grapple and fight in the fore cross trees. The hero is thrown to the deck below. An old skipper finds in the pocket of the injured youth a letter, which discloses his identity as the missing son of the Wall street financier, and he sends a wireless to the anxious father, announcing his discovery.

Another motion picture play has opium smugglers who conceal their booty in various hiding places aboard a vessel. A Secret Service agent sends a wireless ashore, indicating the location of the contraband, and causing the detection and arrest of the smugglers.

That venturesome and adventurous young person, Lucille Love, whose escapades were recorded at length in serial films was assisted from many a scrape and entanglement by the fortunate connivance of the radio message.

In her world-wide pilgrimage, Lucille encountered Hugo Lebeque, the international spy. The spy had placed his valet in the home of Lucille's father as the family butler. With the latter's aid, Lebeque abstracted the plans of the fortifications in the Philippines and escaped on a steamship bound for Hong Kong. The filial Lucille, firm in the determination of sav-



*The conspirators at work in the preparedness movie*

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ing her father from disgrace, pursued the spy. By means of an airship she actually overtook the China-bound steamship. Nothing could ever stop Lucille. Once on shipboard, she quickly recovered the stolen plans, and "wirelessed" her father of her success and her whereabouts. Lucille wasn't either an amateur or a professional operator. She merely "did things" as they came her way.

So soon as the spy discovered her doings, he put the wireless apparatus out of commission. The ship was wrecked, but the fair adventuress and Lebeque were cast up on a desert island. Enough of the wreck was saved to enable them to rig up the wireless outfit, and after having been given up as dead by the outside world, the marooned pair communicated with a vessel that took them home.

All of the foregoing, therefore, informs us of the interesting fact that numerous stars of the movie world are wireless operators of no mean ability. In fact, their managers will assure you that Miss So-and-so and Mr. So-and-so, spent months of intensive study in mastering the wireless art in preparation for their parts. Be that as it may, it will be of interest to many to glance at the names of the most famous wireless operators appearing in the silent drama.

The charming Gail Kane, who starred in "The Miracle Man," is the wireless amateur in "Via Wireless." In "Neal of the Navy," it is Lillian Lorraine, as the professional operator, who saves the Coronado's passengers from the mutineers. In "The Nation's Peril," Earl Metcalfe personates the lieutenant of the United States Navy whose phenomenal work with the radio saves his country from the invader. Hamilton Revelle is the wireless hero in the "The Price of Malice," while in "A Man's Making," George Clarke represents the skipper who communicates the discovery of the missing son to a distressed father by means of the radio. Grace Cunard, of course, depicted the ubiquitous and versatile Lucille Love.

An eminent dramatic writer has said of motion pictures, that "they can never reproduce the brilliant wit of Sheridan, the scintillating verbal sword play of Wilde, or the inimitable dialogue of Shaw." But the silent drama offsets its shortcomings and handicaps with other advantages—the countless variety of scenes, the numberless changes in situations, the swift succession of events.

What an amazing variety is revealed of the uses to which wireless telegraphy is put by the scenario writer. There is the drowning passenger on the sinking yacht—what an added zest is given to the denouement by the S O S signal. How the trite climax of a sea rescue is freshened and rejuvenated by the wireless call. What piquancy is added to the well worn situation of the social drama, by the introduction of a radio message. What a multiplicity of situations is developed by the introduction of wireless in the military play. How the charm of the sea romance is heightened by means of wireless communication with distant sails and shores.

An audience, it is said, is always waiting for something to happen. Well, it happens in the movies when the wireless is at work.

## THE NAVIGATION COMMISSIONER ON WIRELESS

In the annual report of the Commissioner of Navigation, it is declared that the bureau has begun to assemble records of marine casualties in which the wireless system on ships inspected by the department contributed to the saving of life and property. Incomplete returns for the past fiscal year show thirty-six such casualties and in every instance the apparatus worked satisfactorily, the auxiliary set taking up the work of communication when the main set, through the nature of the casualty, was put out of commission. "Radio operators," the report says, "have set for themselves high standards of courage and devotion to duty."

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Vessels Recently Equipped with Marconi Apparatus

| Names | Owners | Call Letters |
|---|---|---|
| Shimosa | Barber & Co. | YOP |
| Texas | Texas Co. | KUM |
| New York | Texas Co. | KUW |
| Floridian | American-Hawaiian Steamship Co. | WLR |
| Artisan | American-Hawaiian Steamship Co. | WKW |
| Arborean | American-Hawaiian Steamship Co. | WLS |
| H. H. Rogers | Standard Oil Co. of New Jersey. | KSI |
| Frederick Luckenbach | Luckenbach Steamship Co. | KGV |
| Nevada | Goodrich Transit Co. | WFD |
| Montcalm | Frederick Leyland & Co. | YPK |
| Manila | S. L. G. Knox. | CEZ (temporary) |
| Luz Bianca | Imperial Oil Co. | VEU |
| Tormentor | Freeport & Tampico Fuel Oil Trans. Corporation. | KFN |
| Buccaneer | Freeport & Tampico Fuel Oil Trans. Corporation. | KFO |
| Barge No. 1 | Inland Navigation Co. | (Not assigned) |
| Lakewood | Port Huron & Duluth Steamship Co. | (Not assigned) |
| Lakeport | Port Huron & Duluth Steamship Co. | (Not assigned) |

## THE SHARE MARKET

New York, March 15.

Since last month all Marconis have been inactive, both American and English shares having a somewhat lower tendency. This, in the best opinion, is the natural result of the paralysis of the war and of the steadily increasing burden of taxes on European investors.

Bid and asked prices today: American, 3⅝—3⅞; Canadian, 1⅝—1⅞; English, common, 9—11½; English, preferred, 8—10½.

## OBITUARY

### Edward L. Young

Edward L. Young, who for eight years was a director of the Marconi Wireless Telegraph Company of America, died at his home in West Thirty-eighth street, New York City, on March 16. He was born in New York in 1855, and was graduated from Columbia University as an engineer. For the last twenty years Mr. Young had been the resident partner of the firm of Takata & Co. He was a member of the Engineers' Club, Nippon Club, Columbia Yacht Club and the Bellport Yacht Club, of Bellport, L. I., his summer home.

### The Cretan and Dorothy Crash

Wireless telegraphy and wireless men worked with their usual effectiveness when the steamships Cretan and Dorothy came into collision off Wimble Shoal, near Cape Hatteras, at fifteen minutes after two o'clock on the morning of February 25. A dense fog prevailed at the time. J. N. Onens, senior Marconi operator on the Cretan, and Alvin Rosenberger, his junior, promptly flashed the S O S and it was answered by the San Jacinto which volunteered to render aid.

While the latter ship was picking her way through the fog, the passengers were transferred to the Dorothy in small boats. There was a gaping hole in the Cretan's side, made by the bow of the Dorothy, and the water which entered the hold had given the vessel a dangerous list to port. The starboard boats were filled with water, and enough of the cargo was shifted to heel the Cretan over until the hole in her side was above the waterline. The San Jacinto was then notified that no further aid was needed and the Cretan limped into port under her own steam. The Cretan's passengers, meanwhile, were transferred from the Dorothy to the steamship Apollo, which was bound for Norfolk, their port of destination.

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# Queries Answered

**Answers will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all letters and only one side of the paper written on; where diagrams are necessary they must be on a separate sheet and drawn with India ink. Not more than five questions of an individual can be answered. To receive attention these rules must be rigidly observed.**

## Positively no Questions Answered by Mail.

L. T., New Orleans, La.:

From the best information obtainable the following values of antenna current may be expected from 500-cycle transmitters. The usual 1 k.w. equipment will supply to the antenna from 7 to 10 amperes; the 2 k.w. sets from 10 to 18 amperes; the 5 k.w. sets from 15 to 25 amperes; the 25 k.w. sets from 35 to 50 amperes; the 50 k.w. sets from 65 to 80 amperes, and the 100 k.w. sets from 95 to 110 amperes. The Goldschmidt alternator at Tuckerton, N. J., supplies from 110 to 140 amperes to the aerial wires. The Marconi station at New Brunswick, N. J., has registered as much as 280 amperes in the antenna circuit.

Regarding the efficiency of wireless stations: A well designed quenched spark transmitter will supply to the antenna circuit fifty per cent. of the energy taken in by the exciting transformer. Apparatus of ordinary design operated at lower spark frequencies generally represents an efficiency in this respect of from twenty-five to thirty-five per cent. The Poulsen arc type of transmitter is said to transfer twenty per cent. of the energy consumed by the arc to the antenna circuit. The average radio transmitter radiates in the form of electric waves eighty per cent. of the energy supplied to the aerial wires.

An exceedingly small amount of the energy radiated by the transmitter is picked up by the receiver aerial. Approximately 40 microamperes of current must flow in the receiving antenna to make a good readable signal.

The relations existing between the current sent out by the transmitter and that absorbed by the receiver are given in the formula evolved by Dr. Austin, namely:

$$I_r = \frac{3.921\ I_s\ h_1\ h_2}{\lambda\ D\ \varepsilon^{.0474\frac{D}{\sqrt{\lambda}}}}$$

Where $I$ = the current in the sending aerial in amperes;
$I^s$ = the current in the receiver aerial in micro-amperes;
$h_1$ = the height of the sending aerial in feet;
$h_2$ = the height of the receiving aerial in feet;
$D$ = the distance of transmission in kilometers;
$\lambda$ = the wave-length in meters;
$\varepsilon$ = the base of the Naperian system of logarithm.

A small amount of the energy absorbed by a receiving aerial flows in the head telephones depending of course upon the type of detector in use. With the larger type of detectors the antenna current varies the current flow of a local battery; hence the windings of the telephones may be traversed by a greater value of current than that picked up by the aerial.

* * *

S. E. C., Jr., Sherborn, Mass., inquires:

Ques.—(1) In connection with an inductively-coupled receiving tuner does it make any difference which end of the coil is grounded?

Ans.—(1) Either end of the coil may be grounded, but it is customary to connect the end or the primary winding nearest to the used turns of the secondary winding, to earth.

Ques.—(2) Is there any advantage in a closely coupled tuner and should the secondary contain as many turns of wire as the primary?

Ans.—(2) If broadness of adjustment is desired and the tuner is to be made responsive to several wave-lengths simultaneously, it is of advantage to construct one that will allow a close degree of coupling. The primary and secondary windings do not necessarily contain the same number of turns because they are used with different values of capacity. For example: The capacity in microfarads of the average ship's aerial is rather low, approximately .001 of a microfarad. The capacity of the amateur aerial is still less, approximately .0005 of a microfarad. It is the general method to connect a variable condenser in shunt to the secondary winding and in consequence the number of turns required in that winding will be gauged by its capacity.

It may be, with certain aerials, that the fundamental wave-length is of such value that only a very few turns are required for obtaining resonance with a distant transmitting station. In this case the primary may consist of a very few turns while the secondary would have a greater number of turns, depending upon the value of capacity connected in shunt. You are advised to purchase a copy of the book "How to Conduct a Radio Club" and familiarize yourself with the principles underlying the actions of receiving apparatus.



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Ques.—(3) Why should the receiving range of my station be almost doubled when the apparatus is located on the ground floor of a building instead of in the third story of the house I live in?

Ans.—(3) The distribution of potential and current along a vertical aerial wire is not uniform and in consequence the amperes of current reach their maximum value near to the base of the aerial. If the primary winding of a receiving tuner is connected in series at this point a greater number of lines of force will be set up for the secondary winding than if it were connected in series at some point further up on the aerial wire. The received energy is distributed more uniformly in a flat top aerial than in one of the vertical type: hence in this case the point at which the tuner is connected is not so important.

Ques.—(4) What is the fundamental wave-length of an aerial 60 feet in height, 240 feet in length, with a lead-in of 40 feet, composed of four wires spaced 3 feet apart

Ans.—(4) Approximately 470 meters.

Ques.—(5) What stations other than Cape Cod send out press reports and what is the wave-length used?

Ans.—(5)

| Stations. | Week-Days. A. M. | P. M. | Sundays. A. M. | P. M. | Average time required. |
|---|---|---|---|---|---|
| Cape May, N. J. | 9:15 | 9 | 9:15 | 9 | 35 minutes |
| Virginia Beach, Va. | 7:45 | 5 | 10 | | 20 to 45 minutes |
| Cape Hatteras, N. C. | 8:30 | 6:15 | 11 | | 20 to 45 minutes |
| Savannah, Ga. | 7 | 7:30 | 7 | 7:30 | 40 minutes |
| Miami, Fla. | 10 | midnight | 10 | midnight | 40 to 60 minutes |

Miami will repeat the midnight press schedule once and will transmit at full power on a wave-length of 550 meters. The other stations also work on 550 meters.

* * *

V. B., Jamaica, N. Y., inquires:

Ques.—(1) Please advise the natural wave-length of an aerial 100 feet in length with an average height of 28 feet.

Ans.—(1) Assuming that it consists of four wires with the usual spacing, it will have a fundamental wave-length of approximately 235 meters.

Ques.—(2) Please tell me how I can increase the pitch of the spark note from an induction coil. I have tried several methods but have failed.

Ans.—(2) It is customary to do this by making the spring on the vibrator more rigid. A small adjusting screw may be attached near to the base of the spring in such a manner as to increase the tension of the spring. It is also effective to reduce the size of the small pieces of soft iron mounted on the end of the spring. An electrolytic interruptor operated from a direct current source of supply will give a high pitched spark note from an induction coil.

Ans.—(3) The accompanying diagram of connections was not understood, but to say the very least it would be difficult to compute the wave-length of a freakish aerial such as your diagram would indicate.

F. H. S., Newfane, N. Y.:

You have neglected to give us the length of the flat top portion of your aerial; consequently we cannot advise concerning the fundamental wave-length. The wave-lengths of four wire aerials are fully covered in the table given in the book "How to Conduct a Radio Club." For the same reason we cannot advise you regarding the range of your transmitting apparatus. It is believed that the capacity of your condenser is too great for a ½-inch spark coil. The coil will cover a greater distance if you will connect the spark gap directly in series with the antenna system and eliminate the condenser.

* * *

J. E. B., Dayton, Ohio, inquires:

Ques.—(1) Can you tell me approximately how many times per second the vibrator on an induction coil makes and breaks the circuit?

Ans.—(1) The number of actual interruptions depends upon the rigidity of the spring of the interruptor and its overall construction. The average interruptor of this type produces about 100 breaks per second, although by shifting the spring frequently, as many as 300 breaks per second are obtained.

Ques.—(2) Can you tell me how far a coherer will respond to a wireless telegraph wave?

Ans.—(2) Contrary to the opinion expressed by many experimenters, the coherer properly constructed is a sensitive receiving detector and will give results comparable to many of the present day detectors. However, it is not amenable to sharp tuning and presents other difficulties which are not in agreement with the requirements of a modern wireless system. A transmitter giving off highly damped waves is more suitable for cohering the particle of the coherer than one giving off more feebly damped waves.

* * *

H. F. W., Chicago, Ill., inquires:

Ques.—(1) What is the wave-length of a three-wire aerial 50 feet in length, 25 feet in height with the wires spaced 2 feet apart? The lead-in wire is 20 feet in length.

Ans.—(1) The fundamental wave-length of this aerial is approximately 120 meters. This aerial connected to the tuning coils you describe will permit adjustments in the antenna circuit to 3,000 meters. Similar adjustments will be obtained in the secondary winding. We do not, however, regard your tuner as representing the best design. It is customary to wind the primary with No. 24 or No. 26

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wire and the secondary with No. 30 or 32 wire.

* * *

G. G. S., Los Angeles, Cal.

The following is an interpretation of the prefixes which you heard:

S is the prefix for a Government message, P for a fully paid commercial message, A for a service message, X for a paid relay message.

The signal, AS, is an intimation for the receiving operator to stand-by or wait a minute. The abbreviation, RDO, is quite universally used for radio; also STR for steamer. The expression "To log an operator" signifies that the activities of the operators on the high seas, particularly if they violate some of the company's rules, are being noted by the operators at a shore station or by one of the traveling inspectors.

It is our understanding that the Los Angeles station to which you refer communicates with a corresponding station in San Francisco.

The salaries paid ship operators are given in the bulletin issued by the Marconi School.

* * *

E. M. S., San Francisco, Cal.:

In the Electrician of February 21st, 1913, formulæ developed by Dr. Louis Cohen are given for the computation of the inductance and capacity of the aerial and hence its fundamental or natural wave-length. If the receiving aerial you refer to is, as you say, placed 50 feet above the earth and consists of four wires spaced 2 feet apart, it will have a capacity of .000000105 of a microfarad for every centimeter of length. The inductance value will be approximately 10½ centimeters for every centimeter of length of the flat top portion. The capacity of the lead-ins will be approximately .00007 microfarads and the inductance about 20,000 centimeters. Add these values and substitute them in the following formula for the approximate wave-length of the antenna system, viz:

$$\lambda = 59.6 \sqrt{L\ C}$$

where $\lambda$ = the wave-length in meters,

L = the inductance in centimeters,

C = the capacity in microfarads.

In the case of an open circuit oscillator a certain correction must be made for the foregoing formula, the matter being fully discussed on pages 209, 210, 211, 212 of the "Wireless Telegraphist's Pocketbook of Notes, Formulae and Calculations," by J. A. Fleming. This volume is sold by the Marconi Publishing Corporation.

With a small condenser connected in shunt to the secondary winding of your receiving tuner it would be adjustable to wave-lengths of 3,500 meters. The receiving range, of course, depends upon the type of receiving detector employed and the local conditions surrounding your station. By this time you have no doubt determined the overall efficiency of your apparatus.

Exceedingly good results are obtained from a vacuum valve bulb employed to amplify the signals received by a crystalline detector, but still better results are obtained by the use of some form of an oscillating vacuum valve, the circuits for which are published in the book "How to Conduct a Radio Club."

We lack detailed information concerning the connection for the high frequency buzzers for communication between battleships, but it is customary to connect a condenser in series with the antenna system and shunt it across the contacts of the buzzer. If the receiving apparatus consists of some form of the vacuum valve amplifier a small buzzer transmitter should cover from 30 to 40 miles.

Concerning the schedules employed by the Key West naval station, you should communicate direct with the commandant at that point.

* * *

C. L. O., Hillsboro, N. H.:

Your transmitting condenser of eleven plates, 4 inches by 5 inches, covered with tinfoil 3 inches by 4 inches, has a capacity of approximately .0012 of a microfarad. The helix, or oscillation transformer, has an inductance of about 15,200 centimeters.

The antenna system 80 feet in length, with an average height of 55 feet, comprising 4 wires, has a fundamental wave-length of approximately 248 meters. The inductance is about 55,000 centimeters and the capacity approximately .00033 of a microfarad. You will now understand that the emitted wave from your transmitter is in excess of that value allowed by law. You might insert a short wave condenser in series with the antenna system or attach the lead-ins in the center of the flat top.

* * *

L. R., Fulton, N. Y.:

Attach the lead-ins from your aerial to the center instead of to the end and the fundamental wave-length will be reduced to a value suitable for operation at a wave-length of 200 meters. To handle the full output of your high potential transformer, you will require a condenser having a capacity so far in excess of that necessary for the 200-meter wave, that your spark gap circuit will be out of resonance with the antenna system.

Connected as an inverted "L" aerial, the fundamental wave-length of your antenna is approximately 200 meters, but if changed to one of the "T" type it will have a natural wave-length of approximately 180 meters.

* * *

J. E. P., Irvington, N. J.:

The diagram of connections accompanying your query is quite correct for an inductively-coupled receiving tuner. The used turns of the primary winding should always face or be placed next to the used turns of the primary winding. In this manner you are assured that the flux of the primary will act directly upon the secondary. Either magnet wire or ordinary copper wire is useful for the windings of receiving tuners.

Your receiving tuner seems to be correctly designed and should give good results.

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A dead-end switch will increase the strength of signals when the lower values of an inductance are in use.

A variable condenser to be connected in shunt to the secondary winding may be built up of 20 or 25 plates, interleaved, having the dimensions you give, namely, a 1½-inch radius.

* * *

H. M. W., Glen Roy, Pa.:

A single coil 3-slide tuner, 10½ inches in length by 3 inches in diameter, wound closely with No. 26 wire, will respond to wave-lengths of 2,500 meters. If desired, a condenser may be connected in shunt to the leads of this tuner to the receiving detector.

It is customary to apply the insulating compound to the coils of receiving tuners, after the winding has been completed. Shellac is generally used. If the tube is to be threaded, as you say, the insulating compound is not required. The terminals of the coil may be fastened to the tube by drilling a small hole in either end and tying the wire in a knot.

The following dimensions are given for a spark coil that will satisfactorily communicate a distance of ten miles. The core consists of a bundle of fine iron wires, ¾ of an inch in diameter by 8 inches in length, wound with a few layers of Empire cloth. Over this is wound 210 turns of No. 16 magnet wire, which is again covered with several layers of Empire cloth. The secondary winding should be made of 1½ pounds of No. 30 enameled wire, which is wound in two sections, each section having a diameter of about 3 inches. The condenser connected across the vibrator should have about 2,500 square inches of tinfoil, separated by thin paraffin paper.

* * *

A. S., Austin, Texas:

Your aerial, 100 feet in length by 45 feet in height, has a fundamental wave-length of approximately 267 meters. If it were reduced to a single wire the wave-length would be slightly less but insufficiently reduced for operation at a wave-length of 200 meters. You might allow this aerial to remain as it is and reduce the fundamental by inserting a short wave condenser in series. Try three plates of glass ⅛ of an inch in thickness and 8 inches square, covered with tinfoil, 6 by 6 inches. Connect these plates in series and then in series with the antenna system. Vary the number of turns of inductance in the antenna system until a wave-length of 200 meters is obtained. If you can arrange to bring the lead-ins from the center of the antenna the fundamental wave-length will be less than 200 meters and therefore satisfactory for operation at the restricted wave.

Ques.—(3) Should a lightning protection ground be separate from the transmitter earth connection, or can these two be connected to the same wire? In the case referred to the wire is attached to the water pipe. If the lightning protection should have a separate ground would a 6-foot iron rod driven into slightly moist earth be sufficient?

Ans.—(3) A connection of at least No. 4 wire should be extended from the lightning switch directly to the earth plate. The earth connection from either the transmitting or receiving apparatus may be attached to the same wire at the most convenient point. A lightning ground should have at least 250 square feet of surface in moist earth.

* * *

H. B., Ashland, Ore.:

Your aerial has a natural wave-length of 215 meters which may be reduced for operation on the 200-meter wave by the insertion of a short wave condenser in series.

Full information for receiving tuners to cover definite range of wave-length is given in the book "How to Conduct a Radio Club," which you must have obtained as a member of the National Amateur Wireless Association. Ascertain definitely the wave-lengths of the stations in your vicinity and be guided by them in the construction of the receiving tuner.

* *

J. P., Sanford, Maine, inquires:

Ques.—(1) Please give me the specifications and directions for constructing a 1½-inch spark coil; also the number of batteries required to operate it and the approximate range that may be obtained with a 100-foot aerial.

Ans.—(1) The length of the core should be 5½ inches, the diameter ½ inch. It should then be covered with a small cardboard tube or two layers of Empire cloth. The primary winding should consist of 220 turns of No. 20 wire which is then covered with one or two layers of Empire cloth. The secondary winding requires 4 ounces of No. 38 B. & S. gauge wire wound in the form of a single section which will have an approximate diameter of 1¾ inches. The condenser in shunt to the vibrator requires between 300 and 400 square inches of tinfoil separated by a thin sheet of paraffine paper. This coil will operate satisfactorily on a 6 or 8-volt storage cell, or on two groups of dry cells, each group consisting of six cells connected in series and the two groups then connected in parallel.

* * *

A. D., Scranton, Pa.:

The entire round of information you desire concerning a receiving tuner adjustable to 10,000 meters is covered in "How to Conduct a Radio Club." The necessary diagram of connections is supplied, together with the dimensions of the coil. The list of the high power stations from which you can receive signals on this apparatus is fully covered on page 850 of the August, 1915, issue of THE WIRELESS AGE. The call letters and the wave-lengths of prominent wave-lengths of prominent wireless stations are given.

* * *

G. L., Poughkeepsie, N. Y., inquires:

Ques.—(1) Will it make any difference in the tuning quality of an aerial system if I attach the lead-in wires about one third from the end? The aerial in question is of the flat top type, 120 feet in length.

Ans.—(1) This will not seriously affect

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the tuning qualities of your aerial, but will decrease the fundamental period or wave-length.

A press report is sent out nightly by the Arlington station at half past eight o'clock, Eastern Standard time.

* * *

L. A. L., Carrington, N. D., inquires:

Ques.—(1) What is the wave-length and capacity of an aerial consisting of six wires spaced 1½ feet, length 80 feet, height 48 feet, with a lead-in of 10 feet?

Ans.—(1) The fundamental wave-length is approximately 236 meters and the capacitance about .000396 of a microfarad.

Ques.—(2) What size spark coil is required to communicate with another station at a distance of ten miles? It is to be used with the aerial described in my first query.

Ans.—(2) To insure continuous and satisfactory communication we advise the use of a 3-inch spark coil.

Ques.—(3) Can I purchase a current reducer to operate either a 1-inch or 3-inch spark coil?

Ans.—(3) You may be able to operate these coils from 110 volt D. C. by means of a proper series rheostat, but because the average amateur spark coil is constructed for use with a 6 or 12 volt storage cell it is advisable to follow suit. A series parallel connection of dry cells can be employed in the same manner. For example: Connect eight cells in series and join three of these sets in parallel.

* * *

W. J. G., Allentown, Pa.:

There is considerable argument in the amateur field regarding the most sensitive of the crystalline detectors. Cerusite and galena are known to be very sensitive, but many amateurs report that for making audible a long distance station, the crystaloi excels all of them.

The cause of static has not yet been discovered. It is sufficient to say that when an aerial wire is erected and connected to sensitive receiving apparatus, it is traversed by a series of electrical discharges more or less intermittent, which seriously interfere with the reception of signals. A series of investigations are now being made by the British Association for the Advancement of Science, and it is hoped from the data being collected that more specific information will be obtainable concerning the causes of atmospheric electricity.

Because you have neglected to give us the diameter of your tuning coils we cannot advise the probable wave-length adjustment. If they are at least 4 inches in diameter the tuner will respond to wave-lengths up to 9,000 meters.

* * *

H. K., Eureka, Ill.:

Your aerial system has a fundamental wave-length of approximately 270 meters and connected to the apparatus described in the second query will, without doubt, allow the reception of signals from commercial stations in the Great Lakes district. If the telegraph wires in the vicinity of your aerial set up interfering sounds, the disturbance can be reduced by placing the antenna proper at right angles to the telegraph wires. If the primary winding of a receiving tuner is fitted with a sliding contact for variation of the inductance value there is no necessity for two multi-point switches, or for a second slider. Connect the earth leads to the terminal of the primary winding nearest to the used turns of the secondary winding.

* * *

E. K., Gloversville, N. Y.:

It would help you in your experiments to purchase a simple text book on wireless telegraphy and study the fundamentals. The dimensions for aerials in compliance with the United States statutes are fully covered in the book "How to Conduct a Radio Club." For operation at the restricted 200-meter wave and if the aerial is to be of the inverted "L" type the flat top portion cannot exceed 50 feet in length. If of the "T" type, the flat top portion may be from 80 to 110 feet in length. Spacing the wires by 2 feet is considered sufficient and it will not help matters to use very large spreaders.

Your second question is an important one. You have already demonstrated to your satisfaction that slate is an improper insulating material for high potential work. You might remove the contacts and switch blade from your present lightning switch and remount them on a piece of good insulating material such as bakelite, dilecto or micarta.

The information you request in your third query is generally covered in text books on wireless telegraphy. If a variable condenser is connected in shunt to a coil of wire it has the effect of increasing the wave-length or time period of oscillation. A variable condenser connected in series with an antenna system will reduce its fundamental wave-length. Connected in shunt to the primary winding of the receiving transformer it will raise the wave-length of the aerial system. If your aerial is so long that its fundamental wave-length is in excess of the wave-length at which it is desired to receive, then a variable condenser becomes necessary. But if the natural wave-length of the antenna is less than that of the distant transmitting station a short wave condenser is not required.

* * *

F. L., Clearfield, Pa.:

No one has so far been able to completely eliminate the effects of static at the receiving apparatus. Many circuits and arrangements of aerials have been devised, but they have the effect of reducing the received signals as well as the static. On a commercial receiving tuner the disturbances from this cause may be reduced by employing between the primary and secondary windings the loosest possible coupling consistent with the strength of signals in the head telephone. In connection with the carborundum crystal, the

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effects of static may often be reduced by causing an abnormal value of battery current to flow through the crystal during the reception of signals.

* * *

C. L., North Adams, Mass.:

Your three-wire aerial, 50 feet in height by 57 feet in length, has a natural period of approximately 195 meters. The capacitance is about .00025 of a microfarad.

Ques.—(2) I have one of the E. I. Company's junior tuning coils, which has metal bars extending through its entire length. Will not this deduct from the strength of signals?

Ans.—(2) It will have no appreciable effect, provided they are of brass or non-magnetic material.

* * *

D. W. G. L., East Orange, N. J.:

To reply to your queries in detail would require too much space in these columns. The information you request is covered in various chapters in "How to Conduct a Radio Club." You are quite correct in believing that the dimensions of the flat top portion of an inverted "L" aerial must be considerably less than that of one of the "T" type for a given wave-length. The purity of the wave emitted from a transmitter is not wholly dependent upon the condenser in the spark gap circuit. It is a function of the radiation decrement and the radiation resistance. Practically any type of aerial will emit a pure wave if the coupling between the primary and secondary windings is sufficiently reduced. The dimensions for the condenser to be used in a spark gap circuit are restricted by the wave-lengths to be employed and the power of the high potential transformer.

The frequency of a Leyden jar or condenser can be computed from the following formula:

$$N = \frac{5{,}033{,}000}{\sqrt{LC}}$$

Where L = the inductance of the connecting leads to the spark discharger

and C = the capacity of the condenser in microfarads.

A table of wave-lengths for small aerials is given in "How to Conduct a Radio Club."

* * *

J. A. K., Tacoma, Wash.:

The fundamental wave-length of your aerial is 210 meters and the capacitance approximately .000268 of a microfarad. With the receiving apparatus you describe you should have no difficulty in receiving the time signals from Mare Island during the night hours. Your daylight receiving range is problematical, depending upon local conditions. You should also be able to hear during the night hours the prominent high-power stations located in Alaska.

The range of your transmitting apparatus will be increased by fitting either a quenching or rotary gap, but it must be carefully designed.

The complete design for a quenching gap and instructions are given in the article of the series, "How to Conduct a Radio Club," published in the February, 1916, issue of THE WIRELESS AGE.

We do not believe that you will be troubled by the alternating current induction motor which is in operation next door to your station; you might be interfered with by mechanical vibration which, of course, you can take steps to remedy.

* * *

F. H. Y., Weyanwega, Wis.:

Your aerial, 58 feet in length with an average height of 45 feet comprising, as we suppose, four wires with the ordinary spacing, has a fundamental wave-length of approximately 185 meters. If the flat top portion is extended to 87 feet, as stated in your second query, the emitted wave will not comply with the restrictions. You might extend the flat portion to this length and attach the lead-ins to the center. With this connection the emitted wave will be within the bounds.

Regarding the reconstruction of the Wood system type "A" transformer you should communicate with the makers of this direct to obtain the required information. An excellent article on amateur transformer construction appeared on page 193 of the December, 1915, issue of THE WIRELESS AGE. The advice given therein may solve your problem.

* * *

J. T., Portland, Ore.:

Communicate with any electrical supply house which makes a specialty of amateur apparatus and determine where the secondary winding can be purchased for your purpose. Note also the announcements of advertisers in this magazine.

* * *

R. U., New Haven, Conn.:

A complete interpretation of the time signals and the accompanying weather reports is given in the booklet issued by the United States Naval Radio Service, entitled "Commercial Traffic Regulaions"; a copy of this can be secured from the Government Printing Office, Washington, D. C.

It is a hard matter for us to trace down the signals you hear from certain stations at a wave-length of 8,000 meters. There are a number of stations operating in the neighborhood of this wave length. A complete list appeared in the Queries Answered Department of the August, 1915, issue of THE WIRELESS AGE.

Your queries concerning condensers, aerials, etc., are covered in "How to Conduct a Radio Club."

* * *

A. D. V., Earlville, Ill.:

A receiving tuner primarily constructed for the reception of signals at a wave-length of 1,000 meters cannot be sufficiently loaded in the primary and secondary circuits for the reception of Sayville signals. A complete

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redesign of equipment is essential and you are therefore advised to construct an apparatus of the type described in "How to Conduct a Radio Club" under the subject of "Beat Receivers." To receive signals at wave-lengths in the vicinity of 8,000 meters a single wire aerial at least 500 feet in length should be erected.

* * *

R. A., deV., Atlanta, Ga.:

There are no spark stations you could hear that operate on wave-lengths in excess of 2,500 meters and in consequence there is no advantage in building a tuning coil to cover an enormous range of wave lengths. A receiving tuner for Arlington time signals and lesser wave-lengths is described in the National Amateur Wireless Association Bulletin for January, 1916. Maximum efficiency at all wave-lengths cannot be expected from a single tuner unless it is fitted with dead-end eliminating switches or constructed in such a manner that the unused portions of the coil can be completely removed from the used portions. Your 300-meter antenna is particularly suitable for the reception of signals from long wave-length stations operating at 2,500 meters and upwards. You are advised to construct a supersensitive receiving set after the plans described in "How to Conduct a Radio Club."

* * *

F. T., Philadelphia, Pa.:

The 150-foot flat top aerial with a vertical height of 50 feet will have a fundamental wave-length of 375 meters. The smaller aerial 35 feet in height by 60 feet in length will have a fundamental of approximately 170 meters. It is not advisable to connect the two aerials in parallel for the longer wave-lengths. The larger aerial will be sufficient for these purposes. When transmitting on the shorter wave-lengths you should disconnect the large aerial by means of a high potential switch. The average ½-inch amateur spark coil will cover from five to ten miles, while a ½ k.w. transformer may do from twenty to thirty-five miles in daylight and considerably further during the night hours.

A receiving transformer for 3,000-meter wave is described in "How to Conduct a Radio Club" and also in the National Amateur Wireless Association Bulletin for January, 1916.

* * *

T. B. T., Jr., Jacksonville, Fla.:

We have had no experience with spirally wound aerials and have only heard of a single instance where one of this type has been employed. Good results are said to have been obtained, but we have never verified them. We can see no advantage in this type of construction.

* * *

C. F. F., Newark, N. J.:

Your aerial has a fundamental wave-length of approximately 100 meters and unless you make use of an extremely sensitive receiving set you will have difficulty in receiving Arlington time signals. Any type of vacuum valve amplification circuit will aid you in obtaining the desired results, but, if possible, you should erect an aerial of increased dimensions.

A receiving aerial only 20 feet above the surface of the earth will probably not give good signals from the Arlington station. It is advisable, if possible, to erect an aerial of at least 40 to 50 feet in height for good signals. A 1½-inch spark coil should enable you to cover from five to ten miles under the ordinary conditions.

* * *

H. C., Palo Alto, Cal.:

The fundamental wave-length of your aerial, 58 feet in length by 38 feet in height, is approximately 170 meters.

An earth connection for a portable set may consist of galvanized iron wire netting or a number of copper wires spread radially over the surface of the earth and directly underneath the antenna system.

As you state, results obtained would indicate that a given transmitting set will cover a greater distance on the Pacific coast than on the Atlantic coast, but no specific comparisons have been made. We frequently hear that amateurs in your district communicate at a distance of several hundred miles with a ½ k.w. transformer.

* * *

A. J. S., San Francisco, Cal.:

The current input to any device taking energy from an alternating current source of supply can be reduced by connecting a reactance or "choke" coil in series. The actual dimensions for this coil cannot be given unless the current in amperes and the range of adjustment required is definitely known.

A reactance coil is of very simple construction, consisting merely of an iron core with several layers of wire from which tapoffs are brought out to the points of a multiple-point switch. You may even do away with the multiple-point switch and regulate the current flow by drawing the iron core in and out of the winding.

* * *

R. T. S., Waterford, N. Y.:

The degree of brilliancy of the incandescent lamp connected in your antenna system is a good indicator of the relative values of energy flowing. The fact that you obtain a brighter light with an ordinary helix than with an inductively-coupled oscillation transformer indicates that the helix permits a closer degree of coupling and therefore passes more energy to the antenna circuit. It may be that the primary and secondary windings of your inductively-coupled oscillation transformer are not in exact resonance; hence the decreased current flow.

Your third query again brings to light a condition which has been observed at many

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stations employing a non-synchronous rotary spark discharger in connection with 60-cycle apparatus. There is a certain number of sparks per second of time that will give the best signals at the receiving station. In addition the sensitiveness of the receiving telephone must be taken into consideration. When the speed of the rotary spark gap is decreased it is very probable that you secure increased amplitude of oscillation for each spark discharge and in consequence better signals are received.

For information concerning the use of the crystaloi detector you are referred to the article on the subject, which appeared in the March, 1916, issue of THE WIRELESS AGE. Due to the fact that this is a detector of low resistance a condenser of a certain capacity is required in shunt to the head telephones.

* * *

W. B., Lima, Ohio:

Your receiving will be considerably improved if you will decrease the flat top portion of your aerial to a length of, say, 40 to 50 feet; also the fundamental wave-length of the antenna can be reduced by attaching the lead-ins to the center of the flat top portion.

A receiving set for a portable equipment is described in "How to Conduct a Radio Club." The windings of this tuner are designed specifically for wave-lengths in the neighborhood of 200 meters. Duplicate the design given and you will have a receiving apparatus that will be particularly responsive to amateur stations. There is no particular advantage in spacing the turns of the wires on a receiving tuner, with the exception that it has the effect of decreasing the distributed capacity. With small windings the effects of distributed capacity need not be taken into account.

* * *

V. C. M., Bucyrus, Ohio:

Your flat top aerial with a horizontal length of 100 feet and an average height of 35 feet has a natural wave-length of approximately 237 meters. If you will attach the lead-ins to the center portion of the flat top you will not require a short wave condenser. The sensitiveness of a crystal is not affected by submerging it in oil and it is often an advantage to do so when the crystal is used in a damp climate. The series of articles entitled "How to Conduct a Radio Club" to which you refer can now be purchased in book form from the Marconi Publishing Corporation.

* * *

N. M., Wavnesboro, Pa.:

The time signals cannot be received from the Mare Island Navy station at your receiving station. The range of this station is limited in an easterly direction.

Galvanized wire often has been used for a receiving aerial, but it is not recommended. If possible copper wire should be employed.

* * *

S. N., New York City:

**The fundamental wave-length of an antenna** is changed very little by the addition of wires in parallel. Your aerial, 125 feet in length with an average height of 45 feet, has a fundamental wave-length of approximately 295 meters. The time signals from Arlington will be received with increased strength on your tuner by connecting condenser in shunt to the secondary winding. With a condenser of .0005 of a microfarad it should be responsive to wave-lengths of approximately 3,000 meters. The range of a 1-inch spark coil transmitting set varies with the location. You may expect to cover from five to ten miles under normal conditions.

* * *

L. H. M., Skagway, Alaska:

Either copper or brass strip may be employed for an oscillation transformer. Of course, the copper will have a higher degree of conductivity.

* * *

F. L. M., Palo Alto, Cal.:

It is next to impossible to estimate the wave-length of a freakish aerial of the type you have described. You are advised to connect a spark gap in series with this antenna and excite it with a small induction coil. Then place a wave-meter in inductive relation to the earth lead and measure its fundamental wave-length. The effective capacity and inductance can be determined by the method described in the book, "How to Conduct a Radio Club." This measurement is very simple and requires only an accurate wave-meter and a Leyden jar of known capacity.

* * *

H. I. W., Canal Dover, Ohio:

Ques.—(1) Approximately, what is the wave-length of an aerial 70 feet in height at both ends, consisting of four wires. The flat top portion is 300 feet in length and the lead-ins are brought from the center of the aerial.

Ans.—(1) The fundamental wave-length of this aerial is approximately 300 meters.

Ques.—(2) Can a 3 k.w. transformer with secondary voltage of 25,000 be used on this aerial and work efficiently on 450 and 600-meter waves?

Ans.—(2) The proportions of this aerial are quite correct for operation at these wave-lengths. The 3 k.w. transformer can be used.

Ques.—(3) What is considered a good value of antenna current on the 600-meter wave with a 3 k.w. transformer operated at full power, the apparatus being fitted with a non-synchronous rotary spark discharger?

Ans.—(3) If the apparatus is efficiently designed throughout and in accordance with the best knowledge of the art, you should obtain from 6 to 9 amperes of current in the average aerial.

* * *

M. A. C., Elkhorn, Wis.:

The fact that your apparatus already receives the time signals from Arlington at noon indicates that it must be fairly well designed. We note from the diagram of con-

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nections accompanying your query that a fixed condenser is not connected in shunt to the head telephones. We are certain that you would receive increased strength of signals if you supplied one of a capacity varying from .003 of a microfarad to .04 of a microfarad. Condensers of this type can be purchased from any electrical supply house at a very reasonable price. We have no additional suggestions to make permitting the reception of signals from Key West, except that you should take into account that this station now operates at certain periods with undamped oscillations at a wave-length of approximately 6,000 meters.

For a condenser to be connected across the telephones, you might try two sheets of tinfoil 6 by 24-inches, separated by a thin piece of paraffin paper. This condenser may then be rolled up in circular form and connections brought out from the two sheets of foil to binding posts. You, of course, understand that the condenser units cannot be rolled up in circular form, unless the foil is completely covered with paraffin paper to prevent short circuiting. It may be to your advantage to secure a copy of the National Amateur Wireless Association Bulletin for January, 1916, in which the dimensions of a receiving tuner particularly suitable for the reception of time signals from Arlington are given.

* * *

F. K. O., Jr., Springfield, Mass.:

You are experiencing the usual amateur difficulties when the house wiring is in proximity to the antenna wires of your transmitter. We fear that your aerial is so close to the power circuit that no amount of protective devices will fully eliminate the induced potentials. Are you sure that you have a perfect earth connection? An excessively long earth lead may set up disastrous inductive potentials in the power wires and this may be the cause of your trouble. Can you not erect your aerial so that the power wires of the house will not be in inductive relation to it?

* * *

W. O., Covington, La.:

We have no suggestions to offer for improvement of your receiving apparatus. The outfit you have purchased is made by a reputable company and should give good results from commercial stations located within your vicinity. Of course, if you expect to do extremely long distance receiving work, you should construct a tuner connected up after some form of the vacuum valve oscillating circuit, which when understood and properly adjusted, gives exceedingly good results from high power stations.

The fundamental wave-length of your aerial is 350 meters, making it particularly effective on commercial wave-lengths.

* * *

P. S., Gilman, Ills.:

Your aerial is well constructed and has a fundamental wave-length of approximately 170 meters which, in connection with the two-slide receiving tuner, supposed to have a capacity of 800 meters, should permit response from commercial stations located in your vicinity.

Regarding your fourth query: Better results are generally secured when the telephones are connected across the fixed condenser, which is in series with the secondary winding of the receiving tuner.

Galena crystals can be purchased from Eimer & Amend, Third Avenue, New York City.

It is a problem to calculate the wave-length of coils from the dimensions you have given. You have not stated the spacing of the wire in either the primary or secondary windings. The information given would indicate that there must be considerable spacing between the turns. Again, we do not know the type of circuit in which these coils are to be used. Are they to be employed as the primary and secondary winding of a receiving tuner, or are they merely single slide or double slide tuning coils to be used in the ordinary manner?

Since a number of days have passed since your query was sent in, you no doubt have by this time ascertained the night range of your receiving apparatus and require no advice from us.

* * *

W. J. H., Brooklyn:

Specific instructions for the dimensions of a loading coil to raise the wave-length of an unknown aerial 400 meters cannot be given unless the exact inductance and capacity of the antenna system with which it is to be employed are known. Litzendraht wire is practical and will give a minimum value of high frequency resistance. If you have available a wave-meter, shunt it with a buzzer and a battery connected in series and set it into excitation at the wave-length desired. Place the coil of the wave-meter in inductive relation to the earth lead of the antenna system and add turns of wire in the aerial circuit until the desired wave-length is obtained. The point of resonance betwen the wave-meter (used as a transmitter) and the antenna system can be obtained by attaching a crystalline detector to one end of the loading coil. The detector is shunted by a pair of head telephones.

* * *

J. E. P., Irvington, N. J., asks:

Ques.—Does the Marconi Company employ draughtsmen, and to whom should one apply for a position?

Ans.—Yes. Apply to the Chief Engineer, 233 Broadway, New York City.

*Many questions received do not appear in these columns because they are not of general interest. Every effort is made to give prompt service, but as we usually have on hand for each issue more than 5,000 queries, it is obvious that all cannot receive immediate attention.*

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# ONLY 30 DAYS MORE
# For Charter Members

# National Amateur Wireless Association

**CHARTER MEMBERS ACCEPTED TO MAY 1, 1916.**

So that clubs may have time to complete organization work now under way, and also to give ample opportunity to all who wish to become Charter Members, an extension has been allowed by the Officers and applications will be received up to May 1, 1916. After **May 1, 1916** the Initiation Fee of $1.00 will be required from all new members.

## OFFICERS OF THE ASSOCIATION.

PRESIDENT, Guglielmo Marconi.

NATIONAL ADVISORY BOARD OF VICE PRESIDENTS

Professor A. E. Kennelly,
Harvard University.
President, Institute of Radio Engineers.

Professor Samuel Sheldon,
Polytechnic Institute of Brooklyn.

Professor Alfred N. Goldsmith
College of the City of New York.

Professor Charles R. Cross,
Massachusetts Institute of Technology.

Hiram Percy Maxim,
President, American Radio Relay League.

Major William H. Elliott,
Adjutant General, Junior American Guard.

Capt. W. H. G. Bullard, U. S. N. Superintendent, U. S. Naval Radio Service.

Col. Samuel Reber, U. S. A., Chief Radio Signal Officer U. S. Army.

E. E. Bucher, Instructing Engineer, Marconi Wireless Telegraph Company.

ADMINISTRATIVE OFFICERS:

ACTING PRESIDENT,
J. Andrew White,
Editor, THE WIRELESS AGE.

MANAGING SECRETARY,
Clayton E. Clayton,
450 4th Avenue, New York.

A national organization of wireless amateurs was announced in the October, 1915, number of THE WIRELESS AGE. Further details of the organization are given in an address made by J. Andrew White, which was published in the November WIRELESS AGE. Reprint copies sent upon request.

## ENROLLMENT OF CHARTER MEMBERS.

Charter members of the National Amateur Wireless Association will be enrolled on special arrangement. Charter members will receive the following:

## CHARTER MEMBERS' EQUIPMENT.

1st. **CERTIFICATE OF MEMBERSHIP.**

The handsomely steel-engraved Certificate, with shadow background half-tone, is sealed and signed by Officers, with the endorsement of Senatore Marconi, as President. Every member will want to frame and place it alongside of his Government License certificate, two documents establishing status as wireless amateurs.

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**2nd. AERIAL PENNANT.**

**The 36 inch aerial pennant, painted in four colors on scarlet felt, will stand long service at your aerial mast head. Every member will be proud of the National Insignia flying from his aerial.**

**3rd. MEMBERSHIP PIN.**

**The National Amateur Wireless Association Pin in gold and enamel is the National emblem of the Association. The design shown on this page can but faintly describe its handsome appearance in three colors and gold. The pin has a special patented hub and shank which permits it being securely fastened on the coat lapel or on the vest without turning upside down.**

**4th. HOW TO CONDUCT A RADIO CLUB.**

**This splendid book, which has been months in preparation and incorporates portions of articles running under the same title in THE WIRELESS AGE, is re-written to cover every new development, and with a large proportion of new matter. It is the foundation stone of the National Amateur Wireless Association activities. Price of this book 50c.**

**5th. LIST OF RADIO STATIONS OF THE WORLD.**

**Revised Edition just published. See advertisement. Regular 50c edition.**

**6th. HOW TO PASS U. S. GOVERNMENT WIRELESS LICENSE EXAMINATIONS.**

**Regular 50c edition of this popular book. Members who already have a copy, see concessions below.**

**7th. MONTHLY BULLETIN SERVICE.**

**It is intended to make the monthly bulletin service for members of the National Amateur Wireless Association one of the most important features of the Association. This bulletin is to be used in connection with "List of Radio Stations of the World" described above. It will carry all additions (both amateur and commercial) to "List of Radio Stations of the U. S.", issued by the Bureau of Navigation, U. S. Department of Commerce, and secured for members** at 18c a copy. The Government list is issued only once a year. The Association Bulletin will keep both lists up to date for you month by month, and in addition, will carry other special and invaluable Association features not obtainable elsewhere

**8th. ONE YEAR'S SUBSCRIPTION TO THE WIRELESS AGE.**

THE WIRELESS AGE is the Official Organ of the National Amateur Wireless Association **and will contain full reports of wireless amateur activities, both national and local. It is planned to give published recognition to individual amateur achievement.**

## CONCESSIONS:

Those who, *during the past six months,* have become subscribers to THE WIRELESS AGE, or have renewed their subscription, or have purchased any portion of the Charter Membership Equipment, may consider such payment as partial payment of Charter Membership Application as given below. If you have paid for a subscription to THE WIRELESS AGE which includes books which are not a part of the Membership Equipment, then you may credit $1.25 of the remittance as partial payment on the Charter Membership. For example, you may have remitted $2.25 for the combination offer of the 1915 Year Book with one year's subscription to THE WIRELESS AGE. In this combination, the price of both the book and the subscription was reduced, to make the special offer; therefore, you may be credited only with that part of the payment which went to the magazine—that is, $1.25. Coupon subscribers receive no credit for trial orders. Subscribers to THE WIRELESS AGE who *began or renewed more than six months ago,* will secure through full Charter Membership fee a renewal for another year; and their subscriptions will be extended for one year from the time the present subscription expires. After May 1, 1916, concessions will be given only on account of previous purchase of the three 50-cent books included in the equipment.

## ANNUAL DUES FOLLOWING FIRST YEAR.

The annual dues are to be not more than $2.00, after the first year. For this, all members are to receive:

1st. The Monthly Bulletin Service.

2nd. THE WIRELESS AGE for one year.

3rd. Special 50c. Instruction Books at 30% off list price.

4th. 10% discount on any book on wireless published, and other features to be announced later.

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**SPECIAL NOTICE REGARDING CORRESPONDENCE.**

As the National Amateur Wireless Association is in no sense a money making enterprise, and as the nominal dues will cover a very small amount of handling expense, it is desired that the correspondence be limited to only the most essential necessities. Many general questions will be answered in the Service Bulletins; special matters pertaining to local questions should be handled through the Corresponding Secretary of Local Clubs and Associations. A cordial invitation is extended to all club officials to write on matters pertaining to organization. This invitation also includes those who are interested in starting new clubs. **Charters:** Out of the amount paid by each member for annual dues, it is purposed to allow organizations that have become part of the National Amateur Wireless Association a rebate of 50 cents out of each $2.50 for their own treasury—a fund to take care of local expenses. Please note that this is a rebate, not a deduction. In order to qualify for recognition as a unit in the National Amateur Wireless Association, a club must have at least five active members and at least one-quarter of its total membership become members of the National Amateur Wireless Association. Clubs securing a charter will have representation in the National Council; this means that they elect their own delegate and thus secure a voice in the management of the Association and in the planning of its future development and activities.

**Clayton E. Clayton, Managing Secretary,**
**450 4th Ave., New York.**

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Checks and money orders should be made payable to: Natl. Amateur Wireless Assn.

**APPLICATION FOR MEMBERSHIP.**

CLAYTON E. CLAYTON, Managing Secretary,

NATIONAL AMATEUR WIRELESS ASSOCIATION, **Date**.....

450 4th Avenue, New York City.

As I desire to receive full recognition as an amateur wireless worker of the United States, I ask the privilege of enrollment as a Charter Member in the National Amateur Wireless Association and request that you send me the Charter Members' Equipment for which I enclose herewith remittance of $2.50.* (Option.)

I trust that you will act upon my application promptly and forward the equipment to me at the earliest possible date.

My qualifications for membership are given in blank spaces below.

Signature ..... .....Age.....

Street Address .....

Town and State.....

Please credit me with $..... paid for.....

* Option.

In the event that an applicant is unable to send the entire amount of the membership dues with this application, the figure $2.50 may be crossed out and $1.00 written in its place. This will be considered an agreement on the part of the applicant accepted for Membership that the balance of dues ($1.50) will be paid at the rate of 50c per month for the next three months, at which time pin, pennant and Certificate of Membership will be issued. The other equipment will be sent at once.

**FILL IN ANSWERS TO THESE QUESTIONS.**

1—Have you a Government License (give number.....) or do you purpose applying for one?.....

2—If you are under 21 years of age, give names of two adults for references as to character.

Reference.....

Reference.....

3—If you are a member of any Local, State or Interstate wireless club or association, give its name, and name of Secretary with address.

.....

4—Are you now a subscriber to THE WIRELESS AGE?.....

5—If you already have any books included in the equipment, state which ones.....

.....

Note: After May 1, 1916, New Members will be required to pay $1 Initiation Fee and $2 Annual Dues.

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# National Amateur Wireless Association

A DIRECTING ORGANIZATION DEDICATED TO THE PROMOTION OF RADIO COMMUNICATION

CALL LETTERS 9PY
S. W. PIERSON
CARROLLTON, ILLINOIS

GUGLIELMO MARCONI, PRESIDENT

Reduced fac-simile of letter head.

## For Clubs and Members of National Amateur Wireless Association

The following list of items of optional equipment is listed at cost price in order to give members and clubs of the Association every material advantage in the way of a complete equipment that may be desired. Prices include transportation charges to 5th Parcels Post Zone. Postage extra to 6th, 7th and 8th Zones.

**LETTER HEADS AND ENVELOPES:**
100 National Association Letter heads with imprint of member at left hand side, as illustrated above 75c
Without member's imprint..... 35c
100 Envelopes with imprint..... 65c
*Special prices on 1000 Letter Heads to Clubs.*

**MESSAGE BLANKS:**
Pads of 50..... 10c

**STATION LOG BOOK:**
A record book in which to keep track of all your operations and communications, in paper..... 15c
in cloth ..... 30c

**RADIO STATIONS OF THE U. S.:**
Call list issued by the U. S. Department of Commerce, postpaid.. 18c

**PHOTOGRAPHS AND PICTURES:**
Photographs of important stations, such as Belmar, Arlington, Sayville, Honolulu, etc., 9" x 12", each ..... $1.00

Duotone picture of G. Marconi, with facsimile signature, suitable for framing ..... 25c

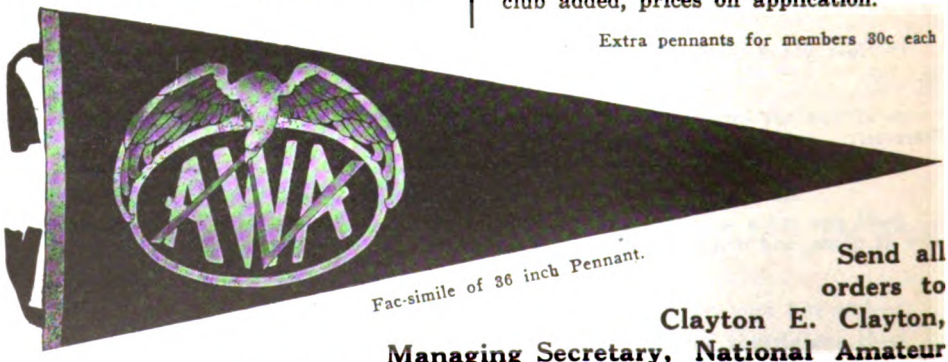
**SOLID GOLD BUTTONS, 14 Karat** N. A. W. A. emblem..... $1.75

**WIRELESS MAP OF THE WORLD** in colors ..... 50c

**YEAR BOOK OF WIRELESS TELEGRAPHY AND TELEPHONY,** published at $1.50, special to members and clubs ..... $1.10

**CLUB PENNANTS:** Made of first quality wool bunting, letters and emblem sewed on with cut outs in color and name of club added, prices on application.

Extra pennants for members 30c each




Fac-simile of 36 inch Pennant.

Send all orders to Clayton E. Clayton, Managing Secretary, National Amateur Wireless Association, 450 Fourth Ave., N. Y. City.

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# THE WIRELESS AGE

Owing to the fact that certain statements and expressions of opinion from correspondents and others appearing in these columns from time to time may be found to be the subject of controversy in scientific circles and in the courts, either now or in the future, and to sometimes involve questions of priority of invention and the comparative merits of apparatus employed in wireless signaling, the owners and publishers of this magazine positively and emphatically disclaim any privity or responsibility for any statements of opinion or partisan expressions if such should at any time appear herein.

MAY, 1916

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# A Night in a Battleship's Wireless Room

THE complexity of the wireless traffic over the North Sea is well illustrated by the story of a correspondent who visited the radio room of a battleship of the British fleet. Not only could he pick up Poldhu, the German press sent out from Nordeich, and the Eiffel Tower, but communication from Madrid, the Russian commander in the Baltic, the Mediterranean fleet, the Admiral of the British grand fleet and the German headquarters were all plainly audible. This, of course, was accomplished by adjusting the apparatus to accommodate the varying wave-lengths.

The wireless officer in charge on the vessel which the writer visited had described it as "a wonderful night for wireless," though the night was muggy and cold. But there was something in the atmospheric conditions which responded exactly to the requirements of the wireless.

The operator had just finished taking the daily news message from Poldhu, the Welsh station of the English Marconi Company, corresponding to the American Marconi Company's station at Cape Cod, which sends press disptaches to Atlantic passenger vessels, and remarked that it ought to be possible in a moment to hear Nordeich, the high power German station which sends out the German press dispatches to ships at sea. The operator had his eye on the clock, whose minute hand was approaching the hour of nine. "He is very punctual, sir, is Nordeich; you can set your watch by him. I dare say he is just knocking out his pipe now; he will start in a minute. If you take the receiver you'll hear him."

"I fitted the receiver over my ears," the correspondent continued. "A black vulcanite disc which regulates and tunes the wave-length to synchronize with one of the many voices in the air, was set to a certain number. I listened; there was a very faint, ghostly chorus of indistinct whines and buzzes, like that coming from a colony of insects disturbed in some affair.

"Punctually as the minute hand rested on twelve, a strong, clear and strident note broke forth into the buzzing. 'There he is,' said the operator, who had a duplicate set at his ear. Nordeich began, as every one begins, by making his call sign, advertising to all whom it might concern that he was about to begin his daily recital of the German version of the war.

"'Now listen to Poldhu,' said the operator, adjusting the apparatus. The strident tones died away and in their place a deep, gruff muttering dominated the air. When I was listening to Nordeich, Poldhu had been among the little minor chorus of whines and buzzes; when the dial-change was made Nordeich sank to join its voice in that background of insect songs, and the rough voice took up the solo. Another adjustment and the gruff voice finished and in its place a musical note, small and bell-like, took up the tale.

"'That is the Eiffel Tower,' said the operator, and my imagination, which had been fixed on that tall group of masts that rises above the heather and gorse on the Downs beyond Mullion, transported itself to the night streets of Paris and that busy network of steel girders among whose interstices a little living, breathing human figure was sitting and pressing a key.

"Again there was an adjustment to reach another wave-length. 'Ah, you have got the Commander-in-Chief,' said the operator.

"But those were not all the wonders shown to me in the wireless office that winter night in the northern seas. It was indeed a 'wonderful night for wireless,' almost unique in the experience of those to whom I was speaking.



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"We heard all kinds of things on that night which are seldom heard together and under the same conditions. We heard the Russian Commander-in-Chief in the Baltic, we heard Madrid and we heard the German Commander-in-Chief from his fastness across the North Sea.

"We heard the British Commander-in-Chief in the Mediterranean; all these of course were call signs known and recognized, but there were many others, coming, no doubt, from places as diverse and remote and as kindling to the imagination, which we did not know or recognize. Yet they were for the most part voices only—voices and nothing else.

"As I was turning away a bitter cry came from somewhere between Iceland and Ireland: 'Daffodil to Ranunculus: Two thousand pounds of marrowfat peas intended for me addressed to you at Happyhaven. Request you will reship same at earliest convenience.'"

## WAR INCIDENTS

In the Judicial Committee of the Privy Council, before Lords Parker of Waddington, Sumner, Parmoor, Wrenbury, and Sir Arthur Channell, the prize appeal case of the Belgia came up for consideration, according to word from Great Britain. The vessel, which was German owned, was on a voyage from New York to Hamburg, when, on August 3 she heard by wireless that war had broken out between France and Germany. Her master determined to run into the Bristol Channel, and got to Newport the following day, but was not allowed to anchor in the harbor. The next morning, war having been meanwhile declared between England and Germany, she was brought into Newport as a prize.

The president found that she was captured at sea on the outbreak of hostilities. From that decision the appeal was brought. Sir Robert Finlay, K. C., having been heard for the appellants, judgment was reserved.

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The French review of events of February 29, has this to say of the loss of a French transport: The auxiliary Provence II., temporarily employed to transport troops to Salonica, was sunk on February 26, in the Central Mediterranean. According to the original reports received, 296 survivors were taken to Malta and about 400 to the Island of Milo by French and British trawlers and destroyers on patrol duty, which hastened to the help of the vessel in reply to her wireless calls.

According to the latest information, there are now at the Island of Milo 489 survivors from the transport Provence, and eighty-five more are shortly expected there on board a patrol boat. The number of survivors is now believed to be 870.

This steamer, known in peace time as La Provence, is of particular interest to wireless men, as it was upon her that some of the earliest experiments with the Marconi Bellini-Tosi wireless direction finder were carried out.

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How wireless is blocking the plans of naval officers to repeat the exploits of Captain Semmes of the Confederate cruiser Alabama is strikingly shown by a message sent broadcast by a British station on March 4 and taken from the log of the operator on the Zulia of the Red D Line. Here is the entry:

Copied the following at 8:40 p. m. on 600 M. German steamer is attacking shipping in the Atlantic and may probably be assisted by captured vessels which she could arm. Description: Six thousand tons, combined passenger and freight ship, two tall masts, guns concealed, speed 15 knots. Poses as neutral, carries torpedoes.

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Reports from several authentic sources are to the effect that the German authorities at Brussels have offered a reward of $2,500 for information as to the location of a wireless telegraph station supposed to be working in some private house in that city. For months it has furnished the people of Belgium with war news which the Germans desired to keep from them, and the search for it has hitherto been unsuccessful.

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# Teaching the Nation's Defenders at the U. S. School for Signal Men

## A Description of Their Training and the General Scope, Method and Usefulness of the Army Division Which They Make Up

IT is truly said that probably in no other branch of the United States Army service are there so many opportunities for character development and vocational training as in the signal corps. One of the agreeable and instructive features is the opportunity for service in various parts of the world, for the men of this corps have the care and operation of wireless stations and a complete network of cable and telegraph lines and telephone systems. These duties take them to all parts of the United States, the Canal Zone, the Philippine Islands, Hawaii and Alaska.

*The old mast standing beside the new steel tower erected by enlisted men in the United States Army Signal Corps School at Bedloe's Island, New York*

More than two-thirds of the men who enlist in or are transferred to the corps, at the expiration of their terms of enlistment are enabled to obtain lucrative employment in civil life, as a result of the technical training and experience acquired during their service in the signal corps. In this connection, Brigadier General George P. Scriven, Chief Signal Officer of the Army, says:

"Service with the signal corps of the army not only offers an excellent career for young, energetic and ambitious men and affords training in the development of self-control and regularity of habits, as well as improvement in physical vigor, but extends excellent opportunities for advancement in many lines of mechanical endeavor, including some of the most useful and unlimited occupations falling to the lot of man."

These words were deeply impressed upon the mind of a staff writer of THE WIRELESS AGE when he paid a visit to the training school for signal men at Fort Wood, Bedloe's Island, New York Harbor. The commanding officer at Fort Wood, Captain A. T. Clifton, Captain of the Signal Corps, very courteously delegated First-class Sergeant E. J. Wessen to explain to the writer the workings of the school. Courses of instruction are given here in military signalling, wireless telegraphy—there is a well-equipped wireless school—electricity, photography, line construction and other matters pertaining to what is known as "The Service of Information."

But where was the signal corps? The wireless school was unoccupied, its technical apparatus untouched. Where were the signal men?

*The forty members of the corps had left Fort Wood that very day for Columbus, New Mexico, to form the nucleus of a field company to be organized there.*



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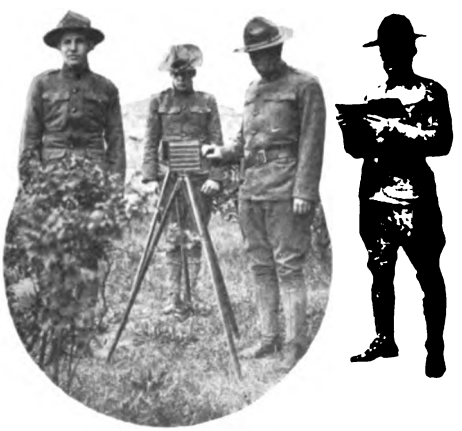
The immmediate adaptability of the school methods to practical service was at once demonstrated. The incident, furthermore, showed the demands that active service makes upon this branch of Army work. Those of us who have followed day by day General Pershing's brilliant pursuit of Pancho Villa—and who has failed to do so?—have become familiarized with the incalculable value of the army signalmen in maintaining lines of communication across desert stretches, and through bleak mountain passes, while aeroplane scouts, preceding the flying columns, inform them of the whereabouts and movements of the bands of bandits scattered through the Sierra Madre Mountains. All this is the work of the signal corps.

The school at Fort Wood, according to Sergeant Wessen, is essentially one for signal corps men. "The men who come here," he said, "are originally supposed to have some qualifications as electricians, telegraphers or trades of that nature. They may be chauffeurs, telephone operators or gasoline engineers. Their future course in the service, their pursuit of special lines of work, depends more or less upon these previous qualifications, and their adaptability in certain directions. But all men must become telegraph operators to some extent, and must learn the two codes, the American Morse and the International Code. Then they become familiar with the different methods of visual signalling, and attend the elementary electricity class. But before they are permitted to attend that class, they are first tested in arithmetic, and if found deficient in that branch of knowledge, they must perfect themselves.

"From the electrical class the men branch out into the lines for which they display their special aptitude. Every man must become familiar with the articles of war, of course, and with rudimentary drills. But actual technical instruction is held of more importance here, and given precedence over military instruction. During the first month at the post, however, the recruit receives one hour daily of military instruction, and all privates, that is members of the signal corps, have to take their turn at kitchen police and cleaning up rooms at the barracks.

"The radio operators attend the wireless school, where all branches of wireless service are taught—from the beginning to the end. This course is supplemented by actual practical construction work in which companies of advanced students are engaged under the supervision of non-commissioned instructors. The repair and construction of radio stations are taught, and the installation of radio towers. In fact, the two towers on Bedloe's Island were constructed by students at Fort Wood, who also installed the wireless apparatus. The wireless school is possessed of portions of all standard makes of sets, and the students are free to experiment with them at any time."



*The Signal Corps heliograph in operation. This instrument is designed to transmit signals by means of the sun's rays, the normal range being thirty miles, and rapidity of transmission, five to twelve words per minute. It is emergency apparatus for use when electrical means of communication have failed*

The first experiments in wireless by the signal corps were conducted in Long Island Sound in 1903, under the direction of Captain L. D. Wildman. The impelling reason for these tests was the fact that the cable between St. Michael, Alaska, and Safety Harbor was continually being worked out by the ice, which would move out in breaking up and carry the cable with it. The tests were made to determine the apparatus best adapted

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*A field equipment of the Signal Corps School set up and working. The apparatus shown here has been superseded by more efficient equipment, increasing the transmitting range and permitting closer wave-length adjustment*

for this service. Communication was established in 1904, and since then there has not been twenty-four hours' interruption in twelve years.

Now high-power stations have been established throughout Alaska. The value of wireless communication was proved, and schools for instruction in the art were formed at Fort Wood, Fort Leavenworth and Fort Omaha. On the Pacific coast there is a 1 k. w. station for the coast artillery. Then there are 10 k. w. stations at Fort Sam Houston, Fort Leavenworth and Fort Omaha. In Alaska there are six 10 k. w. stations and three 3 k. w. stations.

In the field, the men of the signal corps use for advance lines a ¼ k. w. portable set. At the field base they use a 1 k. w. wagon set and for the base of operations a 2 k. w. automobile set. If necessary an auto set can be used at the front. There is a signal school for officers at Fort Leavenworth, where instruction is given in advanced electricity and wireless telegraphy.

At Vera Cruz, in the spring of 1915 the men of the signal corps were confronted with the task of installing a wireless set on a train. The set was put in working order and was in operation all during the operations. The field pack set of the signal corps consists of a ¼ k. w. apparatus with a forty-foot sectional mast in ten joints. Supporting guys form the ribs of an umbrella antenna. This set has been known to work sixty miles and is always good for twenty miles.

The 1 k.w. wagon set and the 2 k.w. automobile set were perfected in the signal corps laboratory in Washington. Their mast is 60 feet in length and consists of ten joints. In the case of the wagon set, the mast is erected by hand, but the mast in the automobile set is erected with the aid of collapsible shear booms on top of the automobile. The antenna in the sixty-foot mast is essentially the same as the other antennae. The range of these sets is about 200 miles. In all portable sets the counterpoise is used instead of actual ground connections.

In the field the work of the wireless sets is supplemented by the use of buzzer lines, which are laid on the ground and in trees, or anywhere so long as

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they are not hindering traffic. Such lines are laid rapidly by troops on a dead gallop, and by the aid of reel carts, specially constructed to carry a number of miles of wire. These

*A portable tower carried by field troops in sections and erected in a few minutes, providing an elevation for observation and visual signaling*

consist of seven strands of very fine piano steel wire, wound around one strand of copper wire. All have insulation designed especially for that purpose.

Naturally, the main function of the signal corps is the transmission of military information, and since in this pursuit are utilized the wireless, the telephone, the land line telegraph the aircraft, visual signalling, and especially many kinds of gasoline engines and motors, these methods are subjects of endless investigation and many possibilities. In addition at the technical schools at Fort Wood, Fort Leavenworth and Fort Omaha, general instructions are given in the care and handling of government property, rendering necessary reports and handling money received at military telegraph offices, as well as the practical military instruction covering the duties of a soldier. At the aviation school at San Diego, Cal., and the aviation center at San Antonio, Tex., instruction is given regarding the repair, maintenance and flying of aeroplanes.

Each field and telegraph company also has its school, in charge of capable officers, where classes are conducted for instruction in the duties performed by the signal corps. Separate laboratories are maintained at Washington, D. C., and at the United States Bureau of Standards in the same city, where detachments of the signal corps on duty at these stations are engaged in experimental work of a most interesting character. They are associated with electrical and wireless engineers of a high degree of training and ability, and this training furnishes opportunities for perfection in technical branches of electrical engineering.

But chief among the subjects taught are wireless telegraphy and modern aeronautics. Both of them are fields that are new and full of promise. The rapid rise of wireless telegraphy has been phenomenal. The United States Signal Corps has applied this means of communication wherever its use is possible. Through the development and construction of its high-power stations in Alaska, the Philippine Islands, and in the

*Soldiers of the Fort Wood Signal Corps School wig-wagging messages in the field*

United States we have seen how it has devised and constructed portable tractors of the automobile type for use at division corps and army headquarters, as well as skid and pack sets for use with small commands. Wireless operators are required for the operation of these stations, as well as expert gasoline-engine men for the high-power

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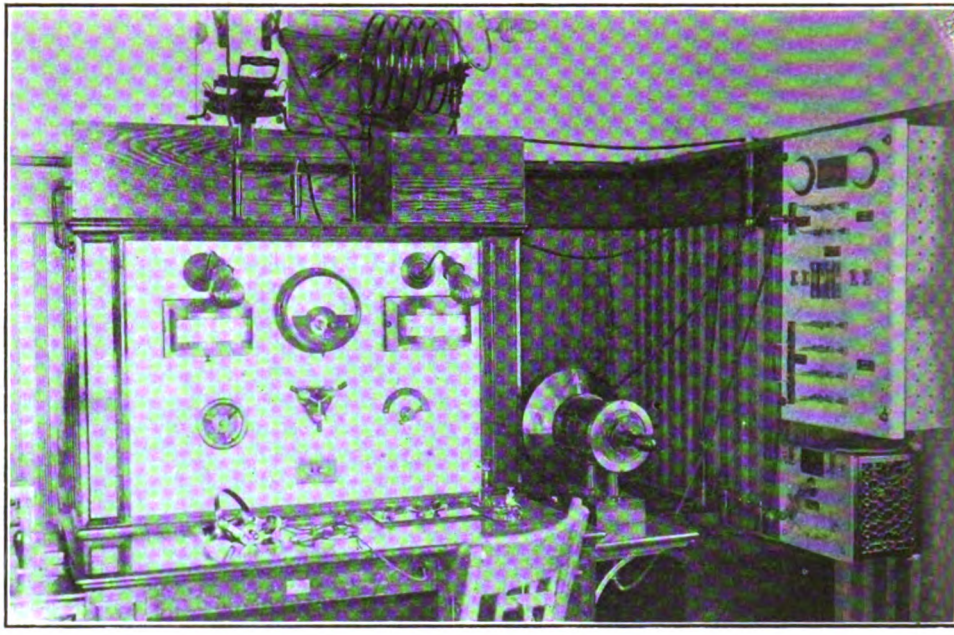

*United States Army Signal Corps wireless station at St. Michael, Alaska*

stations, and chauffeurs with the tractors. The signal corps has also installed wireless stations on all army transports and supplies the operators needed at these stations.

It may readily be seen that a field of experimental work and research work of unlimited value and extent are opened up by the constantly changing aspect of wireless telegraphy and the rapid advance in the instruments employed for wire communication in the mobile army. The signal corps thus offers opportunities for easily and inexpensively acquiring high professional attainments, which may bring success in many important walks of life.

As Sergeant Wessen said, the schools at Forts Wood and Leavenworth cover courses lasting usually from six to eight months, at the end of which the men have ordinarily attained the necessary foundation in theory and practice, enabling them to attend the practical work. They are then sent out to all parts of the United States, the Philippines and Alaska, where they engage in work such as maintaining telephone systems at military posts; become operators at wireless stations, land line telegraph offices and cable stations; gasoline engineers and photographers at detached stations or with field and telegraph companies and linemen. The men who complete courses of instruction at the aviation school at San Diego are usually assigned to duty with aero squadrons at aviation centers.

The signal corps is continually engaged in installing and operating lines of communication as varied as may be found anywhere on the face of the earth. The operation of the Washington-Alaska military cable and telegrapn system furnishes experience in deep-sea cable laying and sending and receiving messages by means of the siphon recorder. In Alaska, in the Southwest, the Philippines, the Canal Zone and Hawaii, the corps constructs and operates wire lines and wireless stations. Then service in the mounted organizations of the corps—field and telegraph companies—adds experience in the care and handling of animals and the novelty of service with line troops of the army.

It is self-evident that no signalman can master a knowledge in all or even most of the subjects taught, but the



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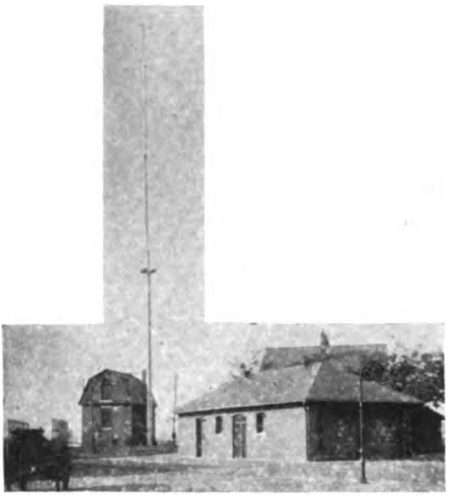
varied operations of the corps make possible the gaining of a vast practical experience.

The Chief Signal Officer, General Scriven has laid particular emphasis upon the importance of the signal corps as an auxiliary branch of the army in the expressed belief that its functions are not in general well understood even by persons who are interested in military affairs.

"There are still people of intelligence," he says, "who in practice believe that the transmission of military thought is summed up in the use of notebook, the orderly, and his horse. But these are passing, and the trained soldier and educated volunteer understand the vital importance of time in military operations and the need for the immediate transmission of information. Hence, the necessity for a signal corps or its equivalent; for without its aid modern armies can no more be controlled than can great railway systems; the commander in the field remains blind and deaf to the events occurring around him, incapable of maintaining touch with conditions, and out of reach of his superiors or those under his authority, upon whom he depends for the execution of his plans. Time is the main factor in war; to arrive first with the greatest number of men, and with the clearest understanding of the situation, is to succeed. The last, and often the first, of these conditions, depends upon the lines of information of the army."

In discussing field lines of information, General Scriven gives an entertaining picture of the detailed work of the signalmen, especially with regard to the adaptation of the wireless in active army service.

He says: "The ordinary lines of information of a division under the three conditions of the camp, the march, and contact with the enemy are worth a word of consideration. Assuming that the division is to be assembled at some suitable locality, and a more or less permanent camp is established, an officer will no doubt first be sent to select sites for the encampments of the various units; quartermaster officers will locate their depots; and the medical officer the field hospitals. It will then become the duty of the signal officer of the division to install the lines of information. With division, corps, and army headquarters there will travel a radio tractor set of the largest or smaller type now adopted by the signal corps, and these will first be put in commission. Then the signal officer will establish at division headquarters a central station and connect this with the most convenient telegraph and telephone offices through which communication may be had with the commercial systems of the country or with the base. He will establish a camp and depot where will be stored all material needed for extended and varied service.



*The old wooden mast at Fort Wood, recently replaced by the steel tower shown on the fifth page preceding. The students of the Signal Corps School erected the new aerial equipment and installed the apparatus*

"Next he will connect by wire or radio with army headquarters (if such exist) and for convenience will carry telephone lines to the chief quartermaster and surgeon, as well as to the depots, hospitals, and corrals. As the troops arrive at their camps, telephone or buzzer lines will be run from the division central to brigade headquarters, the camps of the engineers, the signal corps, the cavalry, field artillery, to independent commands at a dis-

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tance and probably to rear squadrons; through regimental to battalion headquarters; and in case of need to outpost stations or trenches. In a camp of this character the radio—pack, tractor, or horse drawn—should be of great value.

"On the march the lines of information and the stations for a division become fewer and the latter more difficult to reach. Some general considerations may be noted. First, a division on the march must at no time lose electrical connection with its base through the last station occupied, and for this purpose the pack radio may well be used. As the advance continues lines will extend forward, for the radio will maintain communication with the commanding general; that is the advance will be made to some position designated by him as his own during the day or night. This position becomes, so far as the lines of information are concerned, the headqarters. As radio stations advance they should be followed, if practicable by the telegraph train with the necessary material for a line to replace the field or buzzer wire, for the latter is expensive and may be scarce, and resulting faults are sometimes not readily located. Of course, the field line or radio only will be used for rapid work; the latter by the leapfrog method, i. e., by the use of three sections, the rear station jumping past the two preceding and thus constantly maintaining two stations in operation. During halts wire lines can be quickly thrown out, but here visual signalling may be used to adantage, and above all the radio, especially of the wheel type.

*The wireless "Service of Information" at work in Mexico. This remarkable photograph shows the Signal Corps men in actual service maintaining communication between the flying cavalry column and the headquarters of the American punitive expedition*

"The day's march over, the division eats and rests; not so the signalmen. Then radio stations must be established and buzzer lines run from the advance guard, from the flanks, from the corps headquarters, and from the rear to division headquarters, and others laid to outposts and reserves; and still others to detached posts, to observation stations and important stations where pickets are maintained. Again the field radio will be of enormous value.

"In a retiring movement lines of information will be as few as possible, and mainly used to connect the rear guard, probably by radio, with the general commanding. As the division approaches the enemy, the commander will make as certain that his lines of information—wire, radio or aeroplane—connect with corps and army headquarters, with supporting and reserve troops, and with the rear, and when actual contact comes, buzzer lines will be carried to brigades, to regiments and sometimes to the outposts. Of course, when the division is actually engaged against the enemy, its com-

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mander will extend his field or buzzer lines to the positions occupied by the infantry and artillery commands. He will depend in general on the radio to keep him in touch with his cavalry. From events abroad it seems that under no conditions in the field are lines of information of more importance than in the fire direction of field batteries, of enormous guns and mortars and in the trench fighting that has now become so enormously important in a campaign. The radio, though still of unproven value so far as known in aviation work, is of major importance in the field and especially when used at the larger headquarters. It is thought that the four types—pack, divisional tractor, army tractor and skid—now in use or under construction by the signal corps of the army, are quite equal to any elsewhere existing. To these must be added wheel radio of the horse drawn type especially adapted to service with field companies.

"So much for the lines of information of the larger bodies of troops. In the case of a small independent or expeditionary force the problem is easier, but not less important. If operating in an enemy's country, especially if the movements are connected with a boat expedition or with the navy, somewhat less weight must be given to wire communications and more reliance be placed on visual signaling, the aeroplane, and on the portable radio of the field or skid type. With all such expeditions a supply of pistols and day and night rockets should be carried, for they are of value as preconcerted signals, or to indicate location and time."

The signal corps, as at present organized, is made up of one chief signal officer, nine field officers, eighteen captains, eighteen lieutenants, and 1,212 enlisted men. In addition, there are allowed for the aviation section sixty officers and 260 enlisted men. It is maintained that if hostilities should break out this force would be too small. It is now proposed that the proper organization for the signal corps should consist of the overseas garrisons, four tactical divisions, and the coast artillery; and that the auxiliary troops should consist of one chief signal officer, four colonels, twelve lieutenant colonels, fifteen majors, forty captains, 101 first lieutenants, and 3,358 enlisted men. In the aviation section, the proper organization should be one colonel, one lieutenant colonel, eight majors, twenty-four captains, 114 first lieutenants, and 980 enlisted men. Should these organizations be established on the proposed footing, the opportunities in the signal corps would be immensely increased.

It may be of interest to describe in further detail some of the more important technical instruments and apparatus used in the signal corps service. Owing to the great importance of wireless telegraphy in military affairs, much attention is being given to this means of communication. Several types of apparatus have been devised by the signal corps and are in the hands of troops. The first of these is known as the radio tractor. The instruments and switchboards are installed in a specially designed covered body, which is mounted on the chassis of a commercial gasoline truck. Sufficient space is available for the transportation of a crew of ten men. By means of a special clutch and gear the engine is made to drive an alternator for furnishing the necessary electrical energy.

The mast and umbrella type antenna are raised by means of a shears located on top of the tractor, eight minutes being the average time consumed in erecting the antenna and placing the set in operation.

The tractors thus far developed are of 1 k.w. and 2 k.w. capacity. Under ideal conditions the larger set has transmitted messages for distances of 250 miles; the normal range of this type under the most trying atmospheric conditions is 100 miles. The 2 k.w. tractor is intended for use at field army headquarters. Its weight without crew is about 9,200 pounds. The smaller tractor, known as the divisional type, has a range of from fifty to 150 miles, varying according to atmospheric conditions. The weight of this set is about 5,700 pounds without crew.

Both types of radio tractors will, it is

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believed, prove satisfactory under field conditions. But it is probable that horse-drawn sets, specially constructed, must be provided for the field companies.

Two types of skid sets have been developed. These are intended to be transported in escort wagons or similar vehicles. In the smaller (1 k.w.) set the engine and the generator are mounted on skids and can be carried by two or four men. In the larger type (2 k.w) the engine and generator are mounted on separate frames, but so constructed that they can be readily bolted together. The weight of each unit does not exceed 350 pounds.

The receiving and transmitting instruments and switchboard are carried in a fiber case about the size of an ordinary trunk. When not in operation the switchboard lies flat in the case; in use its position is vertical.

The sectional masts and antennae are similar to those used with the radio tractors; that is, sixty and eighty feet long, according to the size of the set.

The receiving and transmitting instruments, which are of the latest type of radio pack set, are contained in a case slightly larger than the ordinary suitcase. The transmitter is supplied with energy obtained from a 500-cycle 110-volt self-excited alternating current generator operated manually by means of two crank handles connected with a series of gears for turning the armature at the necessary speed. The generator and gears are inclosed in a dustproof housing, so arranged that the gears continually revolve in a lubricant. The generator is mounted on a standard.

A forty-foot sectional mast is used. The antenna is of the umbrella type and consists of four stranded wires, each eighty-five feet long, insulated at the open ends and held by guy ropes. Instead of a direct ground connection, a counterpoise, consisting of four insulated wires, each 100 feet long, is radiated from the mast along the ground.

The time required to place the pack set in operation is three minutes. Its range under ordinary atmospheric conditions is twenty-five miles.

Another type of radio apparatus is the radio table set, designed for use on harbor boats employed in the sea coast defenses of the United States and this country's island possessions. Practically the same apparatus as that in the radio pack set is used in the table set, the only difference being that the instruments are mounted on a table, and instead of the hand generator, a motor generator, usually of the 110-volt direct-current type, is used. Current for the motor is supplied from the ship's lighting system. The antenna is erected on the ship's mast and does not form a part of the regular table set equipment.

Due to the fact that signals are transmitted largely over water, the transmitting range is slightly greater than that of the radio pack set.

The service buzzer, one of the most serviceable instruments used in the army, is strictly a portable device and can be used either as a telephone or for sending telegraph signals. When used in the latter way, the sound received in the distant telephone receivers is similar to a high frequency radio spark. Signals have been exchanged over a broken line, both ends of which were slightly grounded. By providing a suitable opening in the leather case for connecting cords and directly over the knob of the sending key a round aperture covered with flexible pigskin, the instruments can be operated with the case closed—a great advantage in inclement weather. An adjustable carrying strap is provided.

Such is the general scope, method, and usefulness of the signal corps of the United States Army, one of the most valuable branches of the military service, on which the country must depend in its hour of danger. Every conscientious wireless amateur, who follows his pursuit with care and energy to perfect himself in his peculiar line, will be one of the prepared men should his country need him—a man specially trained and ready for enlistment in the greater signal corps that the United States must then demand.

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# Insurance for Marconi Employees

## The American Company's Plan of Showing Recognition to Those in Its Service

PERHAPS the most important announcement ever made by the Marconi Wireless Telegraph Company of America to its employees became known publicly on April 1 when the company gave notice that it had put into execution a plan to provide insurance for those in the Marconi service. This means, as set forth in a letter to employees by E. J. Nally, vice-president, and general manager of the company, that those who have been in the service more than one year have been insured for $500, and those who have been in the service five years or more have been insured for $1,000.

It is not likely that a more effective means of showing recognition in an impartial manner to a large army of employees could have been devised, for as the announcement states, "The protection of one's family in event of death is of vital concern," and "the ordinary cost of life insurance in proper amount is so great as to cause a heavy burden upon the income." An additional advantage of the boon is that the insurance can be obtained without medical examination.

Quite properly it has been said that "Created for and continuing its existence of service to humanity, the Marconi . . . Company has taken an epochal step. And the heroic sacrifices which Marconi men have made in faithful discharge of duty, already written into the record, . . . by this act have been monumented with a lasting testimonial more beautiful in spirit than could have been conceived in the rarest marble."

The details of the plan are contained in the letter to employees which follows:

April 1, 1916.

TO ALL EMPLOYEES,

MARCONI WIRELESS TELEGRAPH COMPANY OF AMERICA.

Being constantly mindful of the loyalty and efficiency of our employees, and appreciating those qualities upon which the continued success of our company depends, and after a careful study of more than two years as to the best method of showing our appreciation. it has been decided to maintain for all employees, without expense to them, insurance in the sum of $500.00 for all those who have been with us over one year but less than five years, and in the sum of $1,000 for all those who have been in the employ of the company five years or more.

It gives us pleasure, therefore. to announce that you are now, and from this date, protected by life insurance payable to your beneficiary in the event of death while in our employ, without expense to you.

The protection of one's family in event of death is of vital concern. The ordinary cost of life insurance in proper amount is so great as to cause a heavy burden upon the income. In addition, many would be unable to pass the rigid physical requirements of the necessary medical examination for individual insurance.

We are, therefore, particularly pleased to announce that by arrangement made with The Travelers Insurance Company, this insurance will be granted upon present employees without medical examination.

Attached is a form of application blank. Please fill this out at once and return it to the head of your department through the person delegated to receive it. From the information on this application the insurance will be issued by The Travelers Insurance Company, all charges upon which will be paid by us. In the event of the death of any employee the full amount of the insurance will be paid to his beneficiary. In the

*(Continued on page 587)*



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# In—and Out—of Sayville

**By An Inquisitive Amateur**

I READ with considerable interest the article entitled "A Trip to Sayville," published in the February issue of THE WIRELESS AGE, and it recalled the circumstances surrounding a visit which another inquisitive amateur and I paid to the Long Island station. This is the way our visit—which still remains somewhat vividly in my mind—came about.

My friends and I had spent many of our summer holidays at Sayville, but notwithstanding this fact we knew nothing from actual observation of the interior of the wireless station. Other amateurs, who asked us questions regarding the plant, remarked upon our lack of knowledge in such unmeasured terms that we determined to lose no time in familiarizing ourselves with the station.

It was before the outbreak of the European war that we came to this decision. The first measure to take in the undertaking, we were informed, was to obtain a permit to enter the station. This would necesitate a call at the office of the company controlling the plant—a considerable distance from our homes—and we concluded, therefore, to dispense with this formality.

"What's the use," argued my friend, "they'll probably be glad to see us anyway."

So, having borrowed an automobile, we started. It was four miles from our homes to Sayville and inadvertently we chose a dark night on which to make the trip. When we arrived in the neighborhood of the station we extinguished the lights on the automobile and followed the road with the aid of a pocket light. Arriving at the gate, we left the automobile and, undaunted by signs reading "No Admittance" and "Danger! High Power Voltage," we made our way on foot toward a structure which we afterward learned was the operating building.

The door which we opened showed a room brilliantly illuminated, and filled with apparatus which would have delighted any amateur, but no one seemed to be in evidence but ourselves. On the floor were tubular condensers; here and there were large coil boxes, while in another part of the room were various types of oscillating transformers and a rotary gap.

Our interest in the apparatus was rudely interrupted, however, by the sudden appearance of a man who warned us to leave at once. It is needless to say that we needed no second admonition, but hurried out of the building to the automobile at once. Once seated in the machine we disregarded speed regulations, and put as much distance between us

and the Sayville station as we could in record time.

When we are asked now regarding the plant we reply that we have been in it. We don't say, however, that we were put out of it.



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# Famous Escape of Goeben and Breslau Due to Wireless

## A Vivid Account of the Manner in Which the German Cruisers Pierced the British Line in Their Dash from Messina to Constantinople

A SEMI-OFFICIAL history of the adventures of the Goeben and Breslau is now one of the books of the hour in Germany. Its author is Emil Ludwig, a German author of some distinction, and he says that he acquired the facts at first hand during a visit to Constantinople. It is quite clear that he has had access to the log-book of the Goeben, and that he has received information regarding the famous flight of these boats from the Commander-in-Chief, Vice-Admiral Souchon, whose photograph forms the frontispiece. Official photographs taken during the voyage figure in the volume.

The book, says the correspondent who sends a translation of some salient passages, is written with considerable objectivity, and it would seem that neither the author nor the German sailors, whose mouthpiece he is, bear any rancor towards British naval men. The writer dates the story from July 30, 1914, when he says, the crew of the Breslau gave cheers for the British destroyers Defence and Raccoon—cheers promptly returned—which she encountered. On the evening of the same day the Breslau received the following message from the British ship of the line Gloucester: "To-morrow an English sailor is to be buried; please run your flag down to half-mast." An invitation was extended to the British officers to come on board the Breslau on the following evening. Obviously only the respective staffs knew the possibilities of the European situation. The Gloucester disappeared during the night. Four days later the Gloucester was chasing the Breslau through the Mediterranean seas.

On the same morning on which the British ship had disappeared an order came from the Admiral that the Breslau should leave for Brindisi, there to await instructions. The Breslau weighed anchor and rushed away at 28 miles an hour towards Brindisi. *En route* the following emphatic message was received by the Admiral: "Political relations broken off between Triple Alliance and France, Russia and Great Britain." At one o'clock in the afternoon of August 1 the Breslau came alongside the Goeben before Brindisi. A third ship, a German passenger liner, General, joined the warships at about the same time. The General was off Crete when it got into wireless touch with the Goeben, and at 11 o'clock on the evening of July 31 received the following message: "Don't touch any French, British, or Russian harbor."

At midday on the following day the General received the following message from Vice-Admiral Souchon: "I have requisitioned you. Go to Messina." The Breslau, General and Goeben arrived at Messina on August 2. The Breslau steamed into Messina first, and at once telegraphed to the flagship: "Italian Government prohibits all coaling and provisioning at Italian ports."

The author describes this message as a terrible blow. The bunkers were empty, and yet an allied country refused to sell coal. The Admiral acted. He telegraphed to Rome—"We demand coal." He then demanded and obtained all the



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coal on board the German steamers at the port. All sorts and conditions of Germans helped to coal the warships while the Admiral pored over his maps. Towards midnight on August 2 he sent the following message to the General: "Coal as quickly as possible. Remain at Messina, but be prepared to put to sea at any moment." At one o'clock on the morning of August 3 the Goeben and Breslau put to sea. "Only the Staff knew why and whither." Throughout the next day Souchon anxiously awaited news by wireless, and it was not before six o'clock in the evening that an officer slipped on to the bridge with the following deciphered message: "France has declared war."

No one slept that night. Souchon was hard at work with Captain Busse, his Chief of Staff. "We shall see the Algerian coast at dawn and get the first shot in," he remarked. At two minutes to midnight the following message received by wireless was handed to the Admiral: "Breslau and Goeben must steam with all speed to Constantinople." The message was unexpected, startling, almost incredible." . . . The Admiral resolved to get his blow in at the first hour. . . . "At four o'clock in the morning, in the waning moonlight, the Goeben," says the narrative, "came within sight of the coast of Algiers. In the darkness the ship made for its goal, Phillippeville."

The description given of the bombardment of Phillippeville is vivid and minute. The Goeben, the bombardment over, veered round and made for the open sea, encountering the Breslau, which had previously attacked Bone. A little later the following "open" French wireless messages were intercepted: "Bone est attaqué croiseur allemande se dirige a toute vitesse à Phillippeville. Avisez." "Croiseur allemande apris avoir attaqué Phillippeville, sontinue à l'ouest à toute vitesse."* The admiral laughed as he read the messages. "The detached Breslau," he said, "had evidently done good work."

At 10:50 in the morning the two German ships sighted two British ships, the Invincible and the Inflexible. Later a third British vessel of the Weymouth class joined the latter. Admiral Souchon remarked, "We must use the hours that remain before we are at war with England. Reach Messina. Get coal."

Ships' doctors, officers, and stewards joined in the work of stoking throughout the day, and suddenly at seven o'clock in the morning "we left the Englishmen." At eleven o'clock that night the following wireless from the Admiralty at Berlin was handed to the Admiral: "War with Britain hourly expected." Two minutes later (11:22 at night) the wireless officer deciphered by means of his lamp and his code book the following message received from Norddeich: "Britain has declared war."

The Admiral and his staff were not surprised, but the crew, when the news was communicated to them, "became quiet." At four o'clock in the morning of August 5 the two ships reached Messina. The General was waiting there, laden with coal, but the representatives of the Italian Government refused, on grounds of neutrality, to allow the warships themselves to coal there. Captain Busse, the Chief of Staff, to summarize this part of the story, struck upon the idea of making drunk an English merchant captain whose ship, laden with coal, was at Messina, so that a venial subordinate might be induced to sell the coal to the warships; but the agile British Consul at the port spoiled the plot. In the meantime, however, numerous German trading ships in the port and neighborhood had been summoned, and their coal commandeered by the warships. On the evening of the same day another shock occurred. An Italian officer, "representing the Commander at Messina," arrived, and was ushered into the Admiral's dining-room. The Admiral asked him to take a seat, but he preferred to stand.

"What may I do for you?" asked the Admiral.

"We want to know," replied the officer (in German), "how long the German

Free translation:
* "Bone attacked by German cruiser going full speed to Phillipeville. Advise." "German cruiser after attacking Phillippeville continues west at full speed."

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ships propose to remain here? They can only remain 24 hours—in a neutral port." The semi-official writer proceeds: "The last words came with difficulty from the Italian's lips."

"Very well, I will remain here 24 hours," replied the Admiral. There was a pause. "Of course, I reckon the respite from this moment in which you inform me that Messina is in fact a neutral port."

At midday on August 6 the Admiral issued the following order to the three ships under his command: "News about the enemy is uncertain. I presume his strength lies in the Adriatic, and that he is watching both exits in the Messina Straits. Object: To break through to the East and reach the Dardanelles. Order of going: Goeben leaves at five o'clock, at 17 miles an hour; Breslau follows at a distance of five miles, and closes it up at darkness. I want to create the impression that we are wanting to go to the Adriatic, and in case I so succeed in creating that impression, we shall veer round in the night and make for Cape Matapan, if possible, throwing off the enemy. The steamer General to leave at seven o'clock in the evening, to keep along the Sicilian coast, and to try and reach Santorin. Should she be captured, to try and let me know by wireless. If she receives no further orders from me, to ask for them at Loreley." (Constantinople station ship).

As the ships—flags flying and music playing—were reaching the open sea, the following wireless message from the Kaiser reached the Admiral: "His Majesty expects the Goeben and the Breslau to succeed in breaking through."

Shortly after leaving the harbor an English cruiser of the Weymouth class, alleged to be the Gloucester, appeared on the horizon. The narrative proceeds: The Commander asked the Admiral whether they should open fire. "No; No." Astonishment. The wireless officers were even more puzzled. They could hear the wireless waves being transmitted by the operators on the British cruiser. They did not know the code, but they noted the call and the answer. The German boats were evidently expected, and all preparations for attacking them were being made. The British cruiser was emitting signals in three groups. The word "Mumfu" frequently occurred, and it was clear that it referred to the Goeben. The wireless receivers finally deciphered the signal of the British cruiser as follows: "Goeben making for the Adriatic."

The German wireless officer argued thus wise: "I can jam him. If I break my waves against his I can confuse, hold up, destroy his messages. Shall I jam his wireless?" he asked the Admiral.

"Shall we fire?" asked the Commander.

"No," was the answer to both questions. No one apart from the staff understood the Admiral. This is how he argued, however. "This boat is evidently a patrol intending to wireless our movements to the main British Fleet. He shall save us, not ruin us. He shall do his work. We shall neither fire at nor jam him. Let him wireless that the Germans are making for the Adriatic, whereas the Dardanelles is our object."

It was dark. The Breslau closed in. It was ten o'clock in the evening. Then came the order from the bridge—"Right about; starboard; make for Cape Matapan." The watching British cruiser saw the manœuvre, but before it could wireless the news that the Germans were making for the East the following order flashed out from the Admiral:—"Jam the wireless; jam it like the devil."

The Goeben operators began the work of confusion. Wireless wave broke in upon wireless wave; sound interrupted sound for two solid hours. And during all that time the British Fleet lay securely off Malta and the Straits of Otranto ready to prevent the Germans breaking through into the Adriatic. In those two fateful hours the British wireless operators were able to transmit only a very little, and the German operators and listeners knew that the international signal "V E" ("understood") never came through the air from the British Fleet. The British might have been able after great delay to understand a word or two, but in those critical hours the Germans broke through. Where did the error of our enemy lie? In England the excuse

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was advanced that the Germans had acquired knowledge of the British secret wireless code, and so deceived the latter into waiting. The British should have waited before the Straits of Messina and nowhere else. But so confident were they that the Goeben and Breslau must try and break through to the Adriatic in order to reach an Austrian port that they thought it safe to wait in the Straits of Otranto, which are forty sea miles wide. So positive were they on this point that the thought of our making for the Dardanelles never seemed to have occurred to them. But the lonely British patrolling cruiser kept on with great dexterity throughout the night at its wireless work. A wild weird song of sounds quivered through the air, wireless wave crashed into wireless wave, always confusion and uncertainty.

The writer admits that the wireless messages of the cruiser which he calls the Gloucester evidently reached the British Fleet, but they reached it too late —the German ships were *en route* for Constantinople. Two more wireless messages mentioned deserve reproduction. The first one received on the following day, was as follows:—"Entrance through Dardanelles impossible at present."

The Admiral put it on one side without comment, and continued his course. The other, from the Kaiser, was handed to the Admiral at Constantinople:—"His Majesty sends you his acknowledgments."

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# "A Good Reputation Is a Fair Estate"

I find the National Amateur Wireless Association monthly service bulletin a most valuable source of information. It is worth the whole price paid for the membership. The information gained from this source has previously been unobtainable by the average amateur.

D. R. S., *Louisiana.*

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I am in receipt of the books, etc., with the membership certificate, and am more than pleased with them, having already gotten a fund of useful information from them. I think that the National Amateur Wireless Association is splendid and am glad to be a member of such an organization.

It may interest you to know that I am already teaching two young fellows wireless at the school from which I graduated last year, thereby carrying out the ideas of the N. A. W. A.

A. P., *District of Columbia.*

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Attached find my check for application for membership in the National Amateur Wireless Association. I have seen some of the recent issues of THE WIRELESS AGE, and right now I wish to say that there has never been any publication brought to my notice that takes the place of that magazine—it is up to the minute and full of information interesting both to expert and amateur.

Your work in the organization of a national organization is, indeed, commendable, and I show my approval of it by sending the check for membership and by passing the word around to the "starters" in the wireless idea in this locality.

D. R. L., *Iowa.*

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# How to Conduct a Radio Club

*(Especially Prepared for the National Amateur Wireless Association.)*

## Receiving Tuners for a Definite Range of Wave-Length

By Elmer E. Bucher

Article XXIII

THE wireless experimenter frequently wishes to construct a receiving tuner that has a definite upper range of wave-length adjustment for use with an aerial of given dimensions. It is not possible to give the actual dimensions for a primary winding suitable to all types of aerials as two antenna systems seldom possess identical dimensions or similar values of inductance and capacity. We may, however, take aerials of given dimensions, calculate approximately their inductance and capacity and fit to them a primary and secondary coil properly designed for a distinct value of wave-length.

It is generally assumed and experiment seems to prove that a secondary winding possessing a rather high value of inductance and a correspondingly low value of capacity is the one best suited for the crystalline and vacuum valve detectors. This, together with the fact that the capacity of the usual variable condenser supplied to the amateur market has a maximum value of either .0005 or .001 microfarad—rarely more—will be taken into consideration in the examples to follow. For either crystalline or valve detectors, the condenser in shunt to the secondary winding should not exceed .0005 microfarad. A special example, however, is cited where the capacity of the condenser totals .001 microfarad.

It is found by experiment that No. 32 S. S. C. wire is best suited for the secondary winding of a receiving tuner; No. 24 or No. 26 S. S. C. for the primary winding and No. 22 S. S. C. for the antenna loading coil.

Dimensions for the coils of a receiving tuner to be used with aerials of definite lengths follow:

Example No. 1: Assume that a four-wire flat top aerial of the inverted L type, 50 feet in length, 40 feet in height, the wires spaced 2 feet apart, is being discussed. This aerial is of the correct dimensions for transmission at the amateur wave-length of 200 meters and of course is used for receiving purposes for the shorter range of wave-lengths. The inductance of the aerial is approximately 32,000 centimeters, the capacitance .00022 microfarad, and the natural wave-length about 163 meters. A receiving tuner connected to this aerial and designed to work at the restricted wave-length of 200 meters should have the following dimensions:

The secondary winding is made on a cardboard tube, hard rubber tube or other insulating material, 2½ inches in diameter and wound for a distance of 1 inch with 100 turns of No. 32 S. S. C. wire. When shunted by a capacitance of but .0001 microfarad, the winding responds to a wave-length of about 500 meters and has sufficient proportions to allow the secondary winding to be placed in resonance with the primary winding (adjusted to 200 meters) with practically a zero value of capacity at the variable condenser in shunt. It is recommended that the turns of the secondary winding be equally divided between the points of a four-point switch.

A suitable primary winding for this tuner may be 3 inches in diameter, wound for ½ inch with twenty-eight turns of No. 26 S. S. C. wire. This winding, connected in series with the aerial previously cited, raises the wave-



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length of the antenna system to a value above 200 meters. The primary winding should be fitted with a sliding contact or a multiple point-switch for variation of the inductance values.

Example No. 2: Assume that it is desired to construct a tuner that will raise the wave-length of the aerial described in example No. 1 to an upper wave-length adjustment of 1,000 meters. In this case the secondary winding is 2½ inches in diameter, wound for 2 inches with 200 turns of No. 32 S. S. C. wire. Shunted by a capacitance of .0002 microfarad, which corresponds to the first ten or fifteen degrees of the average small variable condenser, the wave-length of the circuit is 1,150 meters.

Owing to the increased value of the wave-length the dimensions of the primary winding must be increased; it is now 3 inches in diameter, 4 inches in length, wound with 222 turns of No. 26 S. S. C. wire. This winding will, at its maximum value of inductance, raise the wave-length of the antenna system to about 1,150 meters.

The secondary winding should have its turns equally divided between the taps of a 6-point switch, and the primary winding should be fitted with two switches to be described further on.

Example No. 3: A station is fitted with a four-wire receiving aerial, 100 feet in length, 60 feet in height, and a receiving tuner is required for adjustment to a wave-length of 1,000 meters. We may safely assume the capacity of the aerial to be .0004 microfarad; the inductance 62,090 centimeters, and the natural wave-length 300 meters.

The antenna system will respond to wave-lengths slightly in excess of 1,000 meters with a primary winding 3½ inches in diameter, wound for 2 inches with ninety turns of No. 24 S. S. C. wire. A suitable secondary winding has 200 turns of No. 32 S. S. C. wire wound for a distance of 2 inches on a form 3 inches in diameter. Shunted by a capacitance of .00015 microfarad, the winding responds to wave lengths slightly above 1,000 meters. A 6-point switch is sufficient for variation of the inductance value.

Example No. 4: In this case the aerial denoted in example No. 3 is to be raised to a wave-length of 3,000 meters in both the primary and secondary windings. The primary winding is 4 inches in diameter, wound for 6

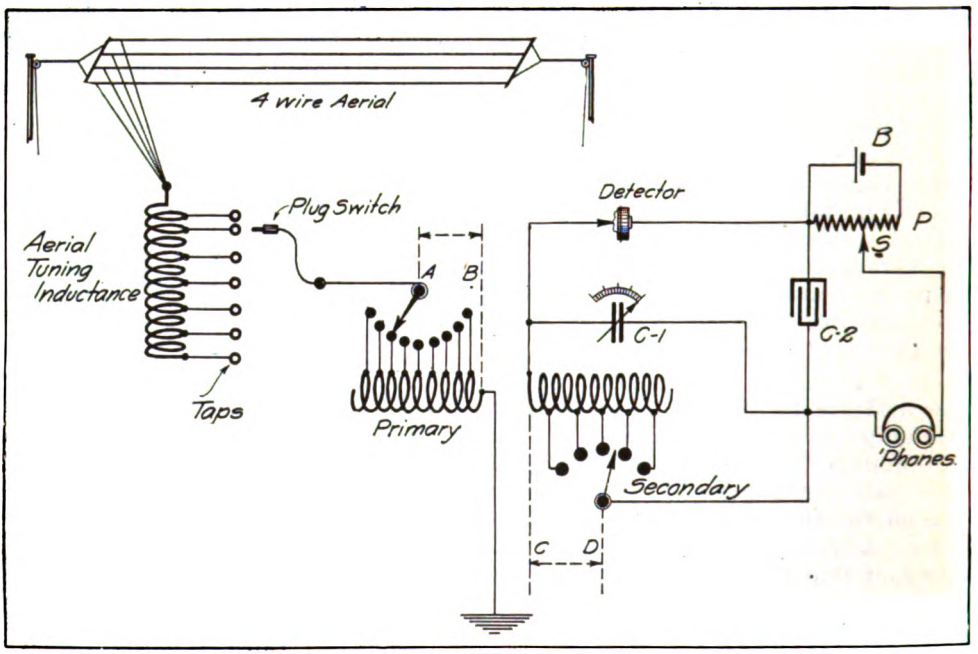


*Fig. 1*

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inches with 275 turns of No. 24 S. S. C. wire. The wave-length of the antenna system is raised to the wave-length of 3,000 meters by the addition of a loading coil which is 4 inches in length, wound for 4 inches with 222 turns of No. 22 S. S. C. wire. The antenna, the loading coil and the primary winding of the oscillation transformer connected in series will cause the aerial to respond to a wave-length slightly above 3,000 meters.

The corresponding secondary winding is 3½ inches in diameter, wound for 6 inches with 600 turns of No. 32 S. S. C. wire. A capacitance in shunt of .0002 microfarad will cause this circuit to respond to a wave-length of 3,000 meters.

Example No. 5: The dimensions of a primary and secondary winding for use at the wave-length of 10,000 meters are often required. The secondary winding, let us say, must possess a particularly high value of inductance in order that it may work with efficiency in connection with the vacuum valve detector. A hard rubber tube or one of other insulating material 6 inches in diameter, wound for 12 inches with 1,000 turns of No. 30 S. S. C. wire, fulfills the requirements. Shunted by a capacitance of .0001 microfarads, the circuit is responsive to the wave-length of 4,950 meters, but with a value of .0005 microfarads connected in at that point, the wave-length of the circuit is slightly in excess of 10,000 meters. This winding is well adapted for the longer range of wave-lengths and may be fitted with a multiple-point switch for variation of the inductance but, as will be observed, the wave-length can be varied over a considerable range by means of a small variable condenser alone.

With an aerial of four wires, 400 feet in length and 100 feet in height, the primary winding may be 7 inches in diameter, wound for 12 inches with 540 turns of No. 24 S. S. C. wire. The antenna system with the maximum value of inductance is responsive to a wave-length of about 11,000 meters. The capacitance of this aerial is about .00127 microfarads, the inductance 192,640 centimeters, and the natural wave-length 970 meters.

Example No. 6: Often for purposes of minimizing space and material, we desire a secondary winding, adjustable to 3,000 meters, to possess a large value of capacity at the secondary condenser and small values of inductance. A tube 3 inches in diameter, wound for 2 inches with 200 turns of No. 32 S. S. C. wire, responds with a capacitance of .001 microfarad in shunt, to the wave-length of 3,000 meters.

A suitable primary winding for the aerial cited in example No. 3 may be 3½ inches in diameter, wound for 4½ inches with No. 30 S. S. C. wire. The antenna system is then responsive to a wave-length value slightly in excess of 3,000 meters.

Example No. 7: In connection with the vacuum valve detector, many amateur experimenters obtain satisfactory results with a secondary winding of No. 36 S. S. C. wire. If the reduction in the cost of material and space is a consideration, a winding of this nature is recommended.

The dimensions for a 10,000-meter winding with a capacity of .0005 microfarad in shunt follow:

The secondary tube is 6 inches in diameter, wound for a length of 6 inches with 820 turns of No. 36 S. S. C. wire. For adjustment to the lower values of wave-lengths it may be fitted with a fifteen-point switch the taps of which are equally divided between the entire winding. The following dimensions for the primary winding and loading coil are correct for a four-wire aerial of the inverted L type, 200 feet in length and 60 feet in height. The approximate inductance of this aerial is 94,800 centimeters, the capacitance .00071 microfarad, and the fundamental wave-length about 450 meters. The primary winding may be 7 inches in diameter and 6 inches in length, wound with 272 turns of No. 24 S. S. C. wire. The loading coil is 30 inches in length and 6 inches in diameter, wound with 1,110 turns of No. 22 S. S. C. wire. The loading coil may be tapped every inch and the primary winding fitted with two switches for variation of the induc-

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tance. The condenser in shunt to the secondary winding may be one of the small Murdock type.

The dimensions given for the secondary windings in the foregoing examples are applicable to aerials of all lengths, but the primary windings must, of course, be altered with aerials of other dimensions. To obtain the correct value of inductance for the primary winding with other aerials a few trial experiments should be made, because if the wave-length of the secondary winding is already known, it

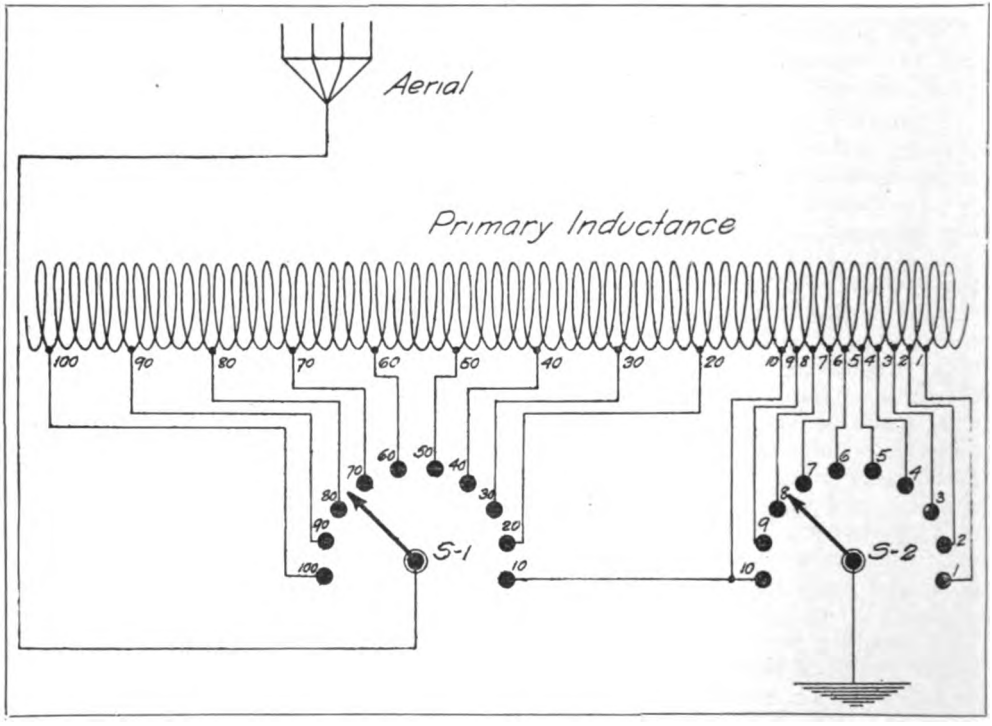


*Fig. 2*

is then only necessary to place the latter in inductive relation with the primary winding and alter the value of inductance at this winding or in the antenna loading coil, until response to a distant station (which is known to be in operation) is obtained.

In the design of a receiving tuner, the precaution to connect the multipoint switch of either winding so that the used turns of the primary and secondary are in direct inductive relation should be taken. They should bear the position shown in Fig. 1 where the turns, A to B, are those in use in the primary winding, C to D, the turns in use at the secondary winding. The zero value of inductance for the primary is obtained at the B end; the zero value for the secondary winding at the C end. And after this essential point is taken into consideration, it becomes self-evident that if the secondary turns are placed too far inside the primary turns, the turns, C to D, are moved beyond the turns, A to B, resulting again in a decrease of the coupling between the windings; hence it may be of value to leave the turns of the primary and secondary exposed in order that the relative position of the two windings may at all times be observed. This is particularly important at the lower values of inductance, but of course is not so essential at the maximum values.

Duplex Switch for the primary winding: To prevent the wires being worn through by excessive friction of a sliding contact, the primary winding of

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modern receiving tuners is fitted with two multi-point switches, as per Fig. 2. The switch, S-2, is connected to the first ten single turns of the primary winding and the taps of the switch, S-1, are connected to groups of ten turns. It is at once evident that any number of turns from 1 to the maximum may thus be included in the circuit. For larger windings, S-2, may be a fifteen-point switch, while the remaining turns may be connected in groups of fifteen to the point of the switch, S-1.

For receiving tuners like those described in examples 5 and 7 it is not entirely essential that switches of this type be fitted to the primary winding. These windings may be tapped every half inch and connected to the points of a single multi-point switch. A variometer similar to that described in the book, "How to Conduct a Radio Club," is connected in series with the loading coil and primary winding to obtain the necessary fineness of adjustment in that circuit.

The fixed or stopping condenser: The condenser of fixed capacity, C-2, indicated in the drawing (Fig. 1) may have values of capacity varying from .003 microfarad to .04, depending to some extent upon the type of telephone in use. This condenser may consist of several sheets of tin-foil, interleaved with thin paraffine paper, and the surface on one side of the condenser must have from 300 square inches to 1,200 square inches of tin-foil. Inasmuch as the dielectric constant of various grades of paper varies and also the fact that the capacity of the unit depends upon the pressure placed upon the sheets of foil and paper, it is not quite possible to give specific dimensions, but for general all around work a condenser should be constructed to have a surface on one side of 600 square inches, the sheets of foil being separated by thin paraffine paper. It is not required that this condenser be constructed of a single large sheet; it may be made of several smaller sheets with dimensions of, say, 4 by 6 inches, the only requirement being that the necessary surface on each side is obtained.

The potentiometer: The sensitiveness of crystalline detectors is enhanced by the addition of a potentiometer of suitable proportions and a small battery, as indicated in Fig. 1. The crystalline detector and potentiometer P may be one of the ordinary type of 400 ohms resistance, but there must be connected in series therewith a fixed resistance of about 1,800 ohms. If, however, a closer variation of the current is desired, the potentiometer, P, may have a resistance of about 2,500 ohms. It may then consist of a hard rubber tube properly threaded and wound with 650 feet of No. 32 "advance" wire, as made by the Driver-Harris Company, New York City. The battery, B, should be one of about 1½ volts. Particular care must be taken to have the polarity of this cell correct. The proper direction of current flow for different types of crystal is best obtained by experiment. Hence, it is of value to fit the battery, B, with a reversing switch, which may be of any design desired.

In a future issue, dimensions for the primary and secondary windings of a receiving tuner for other range of wave-lengths and with different size aerials will be given.

*(To be continued)*

## A CLUB WITH ONE OFFICER

The Advanced Hamilton Radio Association, of Hamilton, Ohio, has rather unusual and interesting ideas in regard to both organization and qualifications. The association is governed by an executive committee of three members. A new member is appointed at each meeting to take the place of the first member, who withdraws There is no officer except a secretary.

Each charter member must possess the following qualifications:

Have a U. S. Government wireless license; skill to send and receive at least twelve words a minute, and at least two years' experience in wireless telegraphy.

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# A Magnetic Amplifier for Radio Telephony*

By E. F. W. Alexanderson and S. P. Nixdorff

THE name of "Magnetic amplifier" has been given to a device for controlling the flow of radio frequency currents because this name seems to describe its function when it is used for radio telephony better than would any other. As the same device can be used for a variety of other purposes the above name may in some cases not seem so appropriate. However, the essential part of the theory that will be given refers to the amount of amplification which is possible of attainment and the methods of securing a higher ratio of amplification than would be given by the device in its simplest form.

The fundamental principle ot varying an inductance by changing the permeability of its iron core is suggested in the early work of Fessenden as a means for changing the tuning of a radio antenna. The magnetic amplifier constructed as shown in Figs. 1 and 2 was, on the other hand, developed as an accessory to an alternator having a solid rotor in order to take advantage of the better mechanical construction of a solid steel rotor and yet produce the results that could be obtained by field control in a machine having a completely laminated magnetic circuit. The aggregate of the constant field alternator and the stationary controlling device has, as will be shown, the effect of a machine with variable field excitation. This analogy refers not only to the proportionality between excitation and electro-motive force but also to such phenomena as self-excitation and instability.

If two windings (e.g., *A* and *B* in Fig. 2) are related to each other and a common magnetic structure as shown in Figs. 1 and 2, it is apparent that there is no direct transformation of energy possible from one winding to the other. Each turn in the controlling or exciting winding *B* includes both the positive and negative branch of the flux produced by the A. C. winding, *A*, and hence there is no voltage induced in *B*. The current in either winding *A* or *B*, on the other hand, influences the permeability of the common magnetic material; and, therefore, changes the inductance of the other winding. If a current flows in either winding sufficient to saturate the iron, it is thereby rendered practically non-magnetic and the inductance of the other winding is reduced to the value it would have if the coil included only air. If, on the other hand, a current flows in the other winding which gives a magneto-motive force equal and opposite to the first, the iron is rendered magnetic again. Inasmuch as the two branches of winding *A* are wound relatively opposite to winding *B*, the one branch will oppose the ampere-turns of winding *B* on one-half cycle. and the other branch during the next half cycle. In order to have any large flux variation in winding *A*, the opposing ampere-turns must be at least equal to the ampere-turns in winding *B*. The relation of currents in these windings is substantially the same as that between the primary and secondary current in a transformer, although in this case one is an alternating and the other a direct current, or a current of a different frequency. It is thus obvious how the current flow in winding *A* can be regulated in proportion to the controlling current in winding *B*. When the magnetic amplifier is used in shunt to the alternator (Fig. 2), it has the immediate object of controlling the voltage rather than the current. The combined characteristics

* Presented before The Institute of Radio Engineers, New York, February 2, 1916. Reprinted by permission of The Institute of Radio Engineers.



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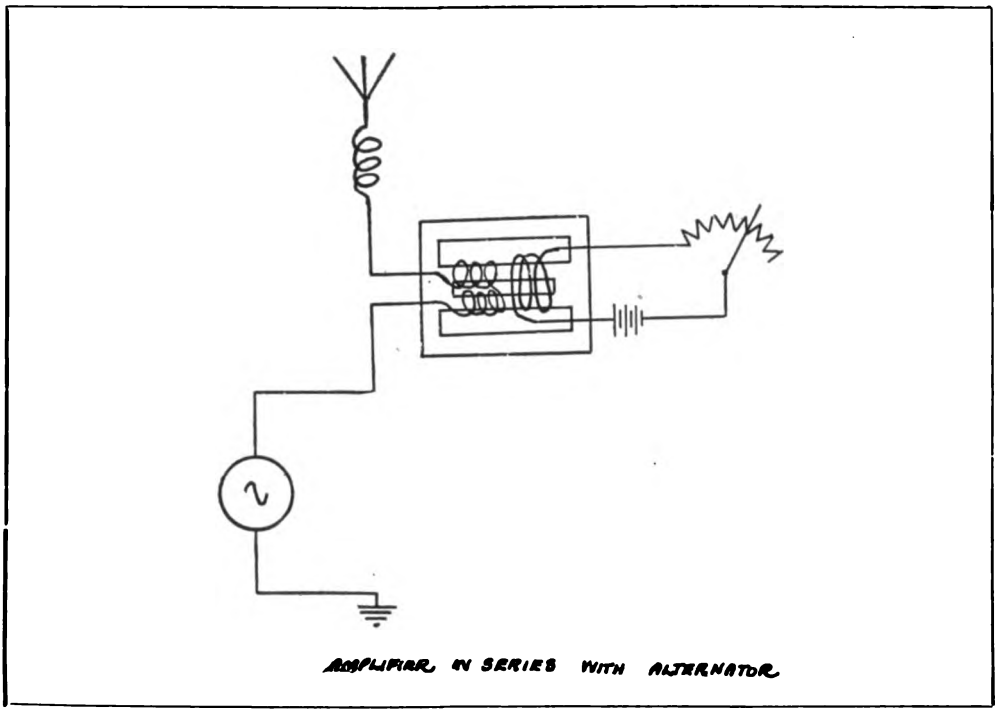


*Fig. 1—Combination of alternator and amplifier in a simple form*

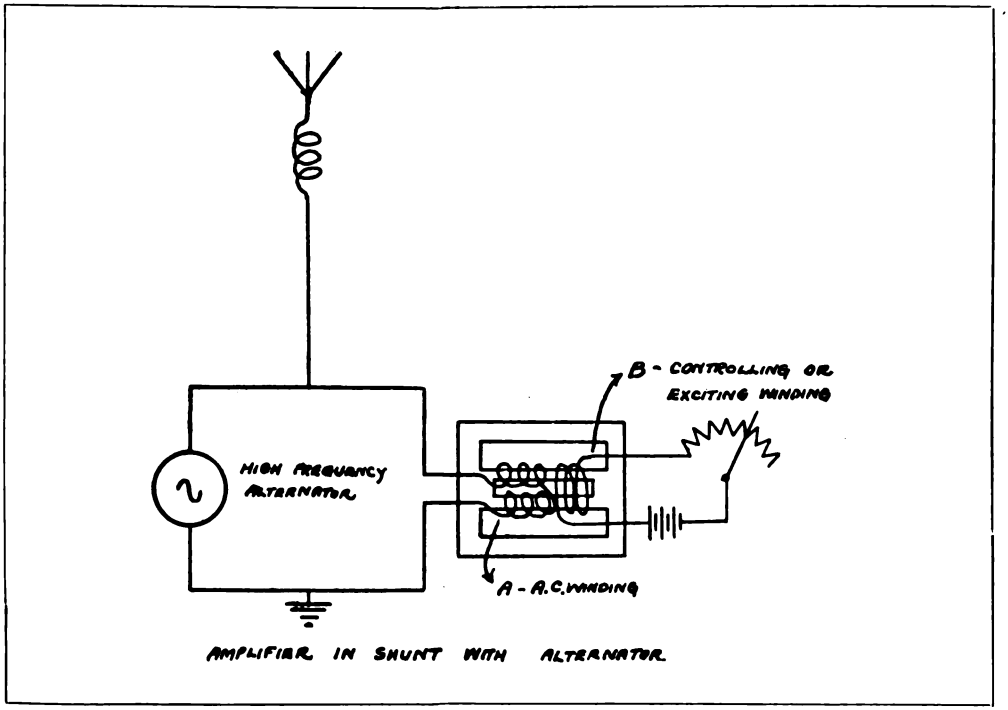


*Fig. 2—Combination of alternator and amplifier in a simple form*

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can be derived from the separate characteristics of the alternator operating on an antenna, and of the alternator controlled by a variable shunt across its terminals, as shown in Fig. 5.

As indicated in Figs. 1 and 2, it is possible to connect the amplifier either in series with the alternator or in shunt to the alternator. Of these two arrangements, the shunt connection is preferable because the effect of the amplifier on the alternator is the same as if the electromotive force of the alternator in the antenna circuit had been reduced; whereas the amplifier in the series connection does not influence the electromotive force in the antenna circuit but changes the tuning of the antenna. The result of this change in antenna tuning has an undesirable effect on the speed characteristics of the alternator, because it is found upon further analysis that the control does not become effective unless the alternator is operated on the upper or unstable side of the tuning curve of the antenna. If, on the other hand, the alternator is operated on the stable side of the tuning curve, the change in tuning partly neutralizes the intended controlling effect.

### Ratio of Amplification

The method of arriving at a theory for the ratio of amplification can perhaps be best explained by the following mechanical analogue:

A throttle valve in a steam pipe may be designed so that it is perfectly balanced and it might move on ball bearings so that an infinitely small effort would be sufficient to throttle an infinitely large flow of power. If, on the other hand, the valve were to be opened and closed 1,000 times in a second, the accelerating of the moving parts against their inertia would intermittently absorb considerable energy. Although this would be "wattless" energy (inasmuch as the energy consumed in accelerating would be given back in retarding), the device which performs this movement must control considerable power. In addition, if there be frictional resistance to motion, still more energy will be required *throughout* the cycle, and this is not "wattless" energy. In analogy to this, we must ask ourselves what are the corresponding "wattless" and "watt" energy in our magnetic valve which must be overcome in opening and closing it at the frequency of a telephone current. The answer is: the "wattless" energy is that required to create the magnetic field neglecting hysteresis (and eddy current losses). The "watt" energy is that lost during any number of cycles because of hysteresis. This energy is the integrated area of the saturation curve between the limiting points between which the changes take place. The energy of the controlling field is not necessarily equal to the energy of the radio frequency field but of somewhat the same order of magnitude. The wattless flow of energy is proportional to the energy per cycle and the number of times per second the energy must be delivered and returned. It can, therefore, be said that the ratio of amplification is proportional to the ratio between the frequency of the radio current and that of the controlling current.

However, the assumption that the energy per cycle is the same in the radio frequency and in the controlling circuit is only a first approximation. The object of design and improved arrangements is evidently to make this energy ratio as favorable as possible; in other words, to produce a maximum flux variation in the radio frequency circuit for a minimum variation in the controlling circuit.

In order to understand these relations it is necessary to make a further study of the laws governing changes of permeability. The object of the magnetic amplifier, when used for radio telephony is not only to control the radio energy but also to reproduce a telephone current in its true shape. An important part of the analysis is, therefore, a study of the conditions that lead to linear proportionality between the controlling and the controlled current.

### Magnetic Theory and Characteristics

The magnetic amplifier can be operated in two ways, as indicated by the diagram in Fig. 6. In one case, when the two A. C. windings are in series, the current in both windings is definite; and the flux in the corresponding branches of the core adjusts itself accordingly. In the second case when the two A. C. windings are in multiple the currents in

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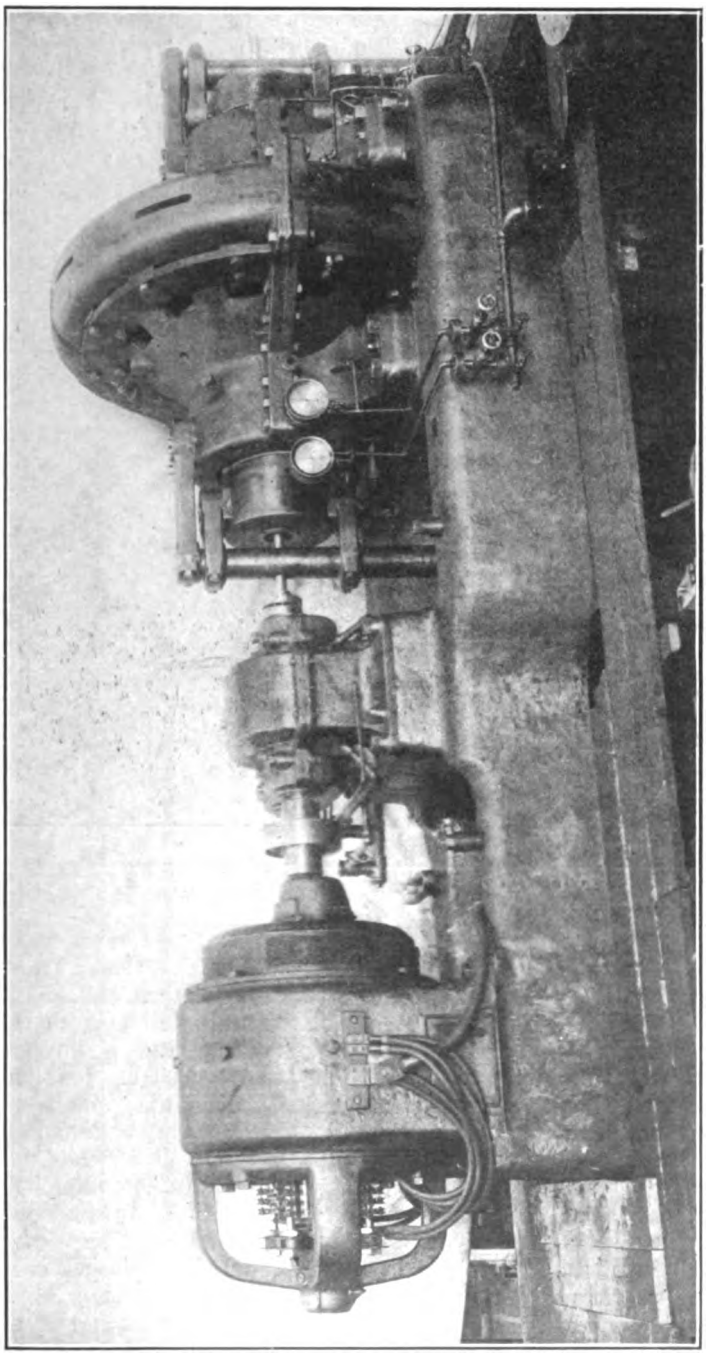

*Fig. 3—75 k.w. radio frequency alternator used for tests*

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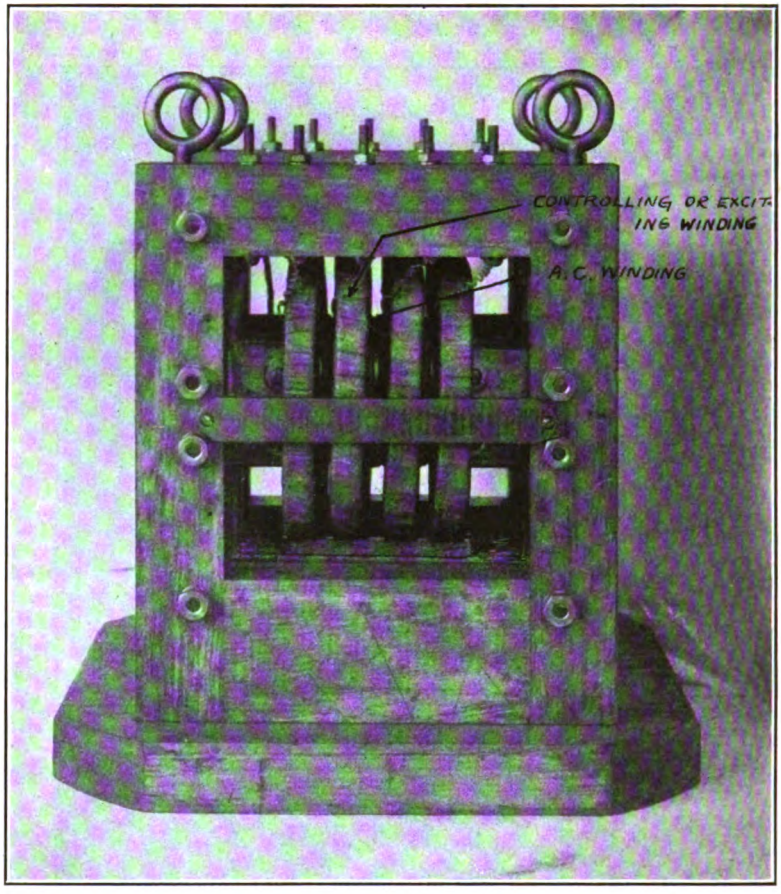


*Fig. 4—Amplifier coil used for tests*

each winding are not immediately obtainable; because a cross current of a strength not yet defined may flow between the two windings. We know on the other hand that the flux variations in the two branches of the core must be identical, inasmuch as they produce the same terminal voltage in the multiple connected windings.

The characteristics of the amplifier winding in series and multiple connection, as obtained from tests, are shown in Figure 6. The upper curve represents series and the lower, multiple connection. The curves are plotted in ampere-turns and volts per turn, so as to make the conclusions independent of the number of turns. Both curves represent the same D. C. excitation. These curves, as well as theoretical considerations, show that the multiple connection gives a lower curvature and a lower impedance. For zero D. C. excitation it is evident that the volt-ampere curves for these two connections must be identical. It thus follows that the change of impedance corresponding to a given D. C. excitation is greater with the multiple connection. The multiple connection is, therefore, altogether more advantageous because a lower impedance with a certain control excitation means greater sensitiveness; and a lower curvature means that larger currents can be carried without causing instability, as will be shown later. While thus the second

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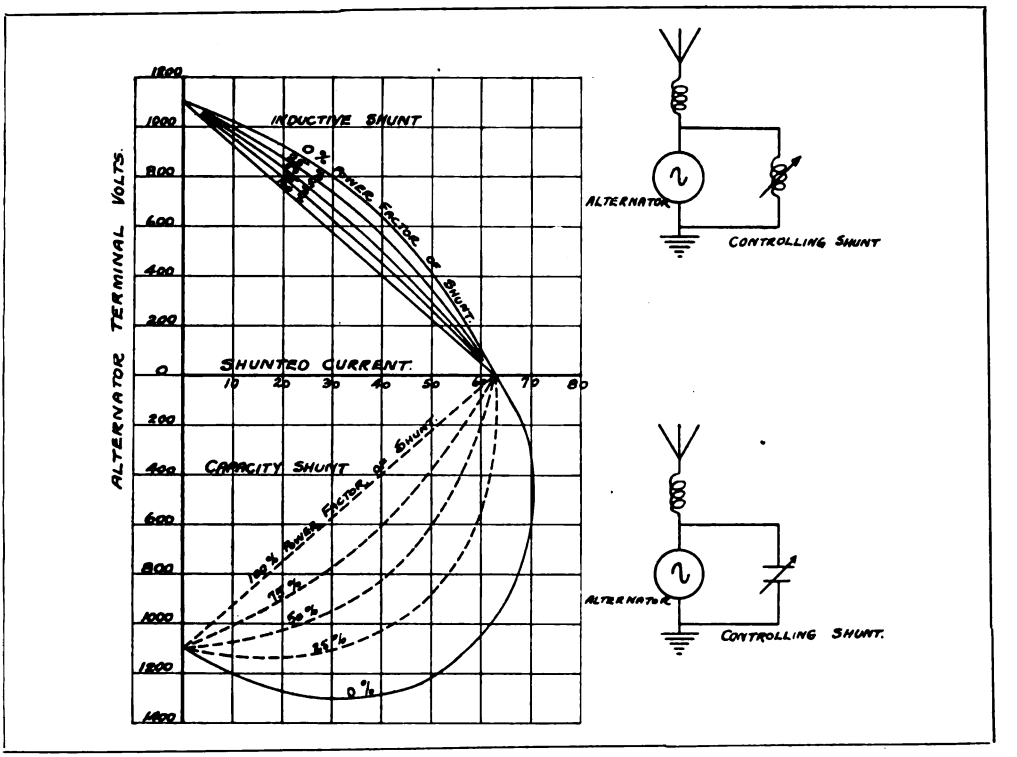


*Fig. 5—Characteristics of alternator when controlled by variable shunt impedance*

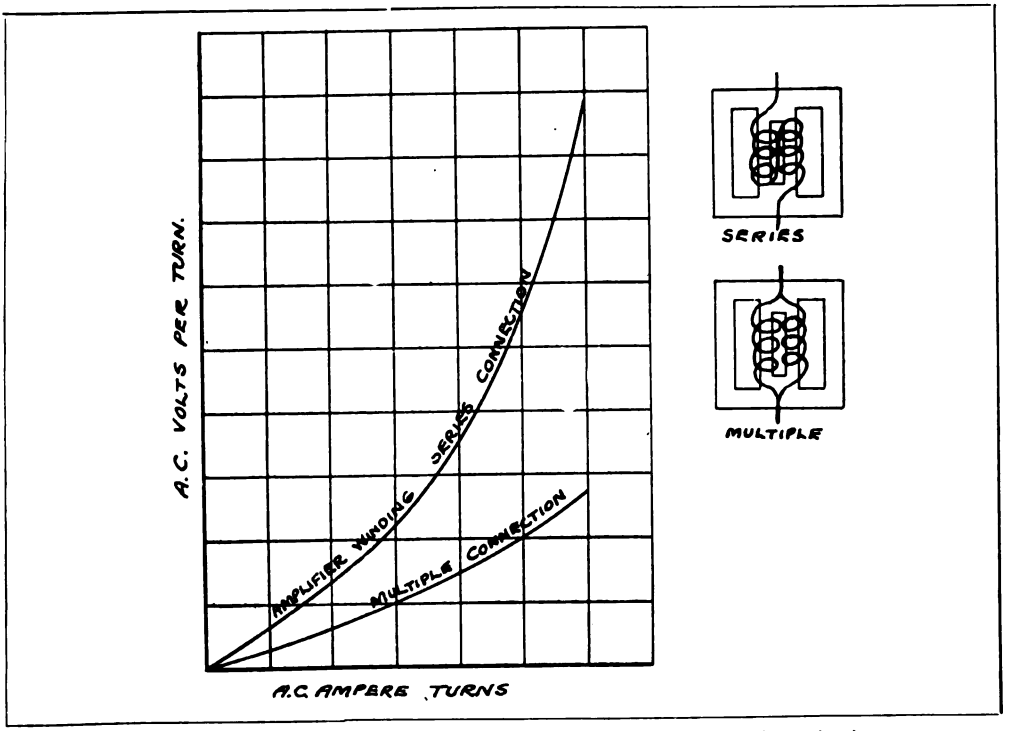


*Fig. 6—Comparative volt-ampere curves with the same D. C. excitation*

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mode of operation with multiple A. C. winding appears to have better characteristics, there are some other considerations which must be taken into account before it can be concluded that this connection could be used.

**Object of Short Circuit Condenser**

In the multiple connection, the flux of the fact that the A. C. winding needs to operate only at radio frequencies, which are very much higher than the frequency of the telephone current. It is, therefore, possible to find a condenser of such value that it acts as a short circuit for the radio currents and on open circuit for the telephone current.

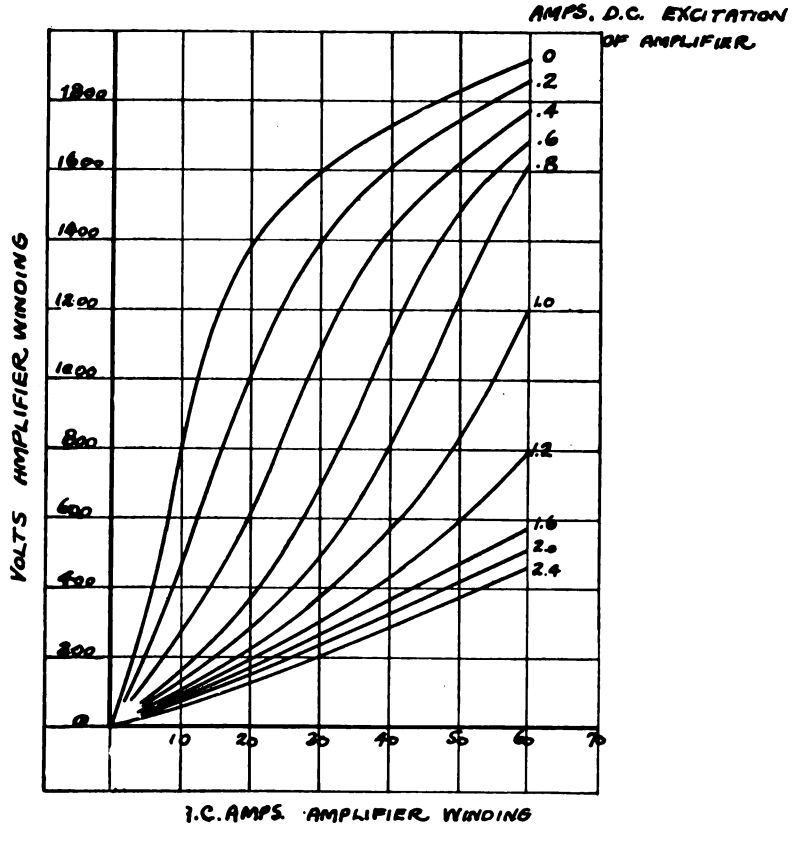


*Fig. 7—Characteristics of amplifier coil windings in multiple*

variations are forced, as already explained, by the short circuit that is formed between the two multiple coils. The induced current in this short circuit tends to oppose any changes in the average flux, and thus a telephone current in the controlling winding would simply cause a corresponding short circuit current between the two A. C coils without producing the desired flux variations. This difficulty can, however, be overcome by taking advantage Accordingly a condenser is introduced in series with each of the A. C. coils, as shown in Fig. 9.

**Combination of Alternator and Amplifier**

In order to demonstrate how the magnetic amplifier can be used for controlling the voltage of an alternator, reference may again be made to the alternator characteristics, as shown in Fig. 5. The alternator voltage is plotted against the current in the shunt cir-

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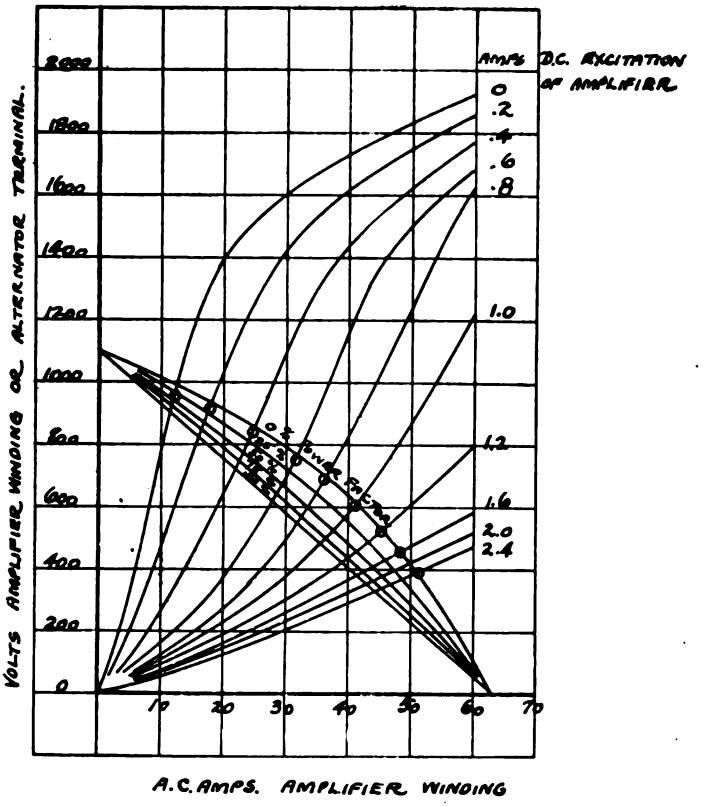


*Fig. 8—Alternator and amplifier characteristics superimposed*

cuit. The magnetic amplifier is used as this shunt circuit and the volt-ampere characteristics of the amplifier can, therefore, be directly combined with the volt-ampere characteristics of the alternator. The volt-ampere characteristics of the amplifier are shown in Fig. 7. Fig. 8 shows the alternator and amplifier characteristics superimposed. The intersections between the sets of curves give the alternator voltages at the corresponding amplifier excitations, and thus another curve can be plotted between alternator volts and amplifier excitation. This curve, as obtained from test, is the upper curve in Fig. 9, which approaches the X axis asymptotically with increasing excitation of the amplifier. It is possible in this way to reduce the voltage practically to zero without using an excitation which is excessive from the point of view of heat capacity of the exciting winding. A magnetic amplifier may be used in this way as a controlling device for radio telegraphy. However, in this form, it is not well adapted for telephony; because, as shown by the curves, the relation of volts of alternator to amperes of excitation departs too far from the desired linear proportionality. Such proportionality can be obtained by the introduction of a series condenser, as shown in Fig. 9, while at the same time the sensitiveness of the amplifier is greatly increased so that a much smaller control current is needed. If the condenser is chosen so that it exactly neutralizes the inductance of the amplifier winding at some definite value of excitation, the resulting impedance at this excitation becomes a minimum; and the impedance at any lower excitation is determined by the

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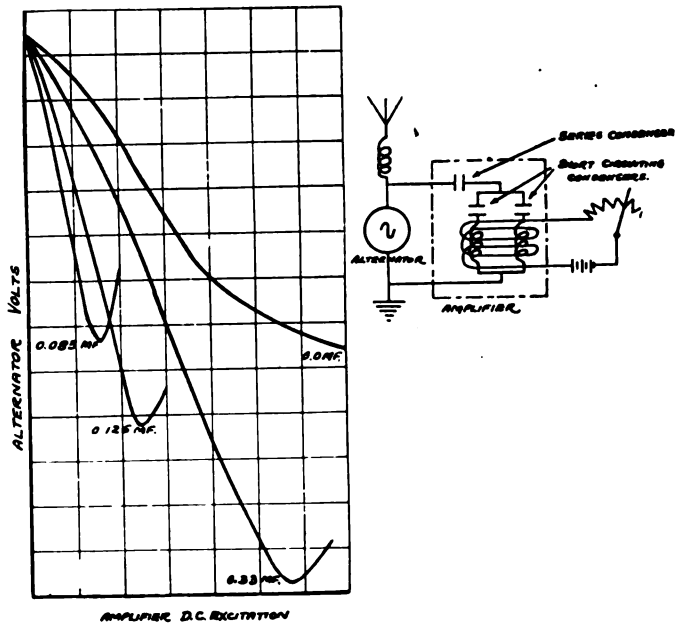
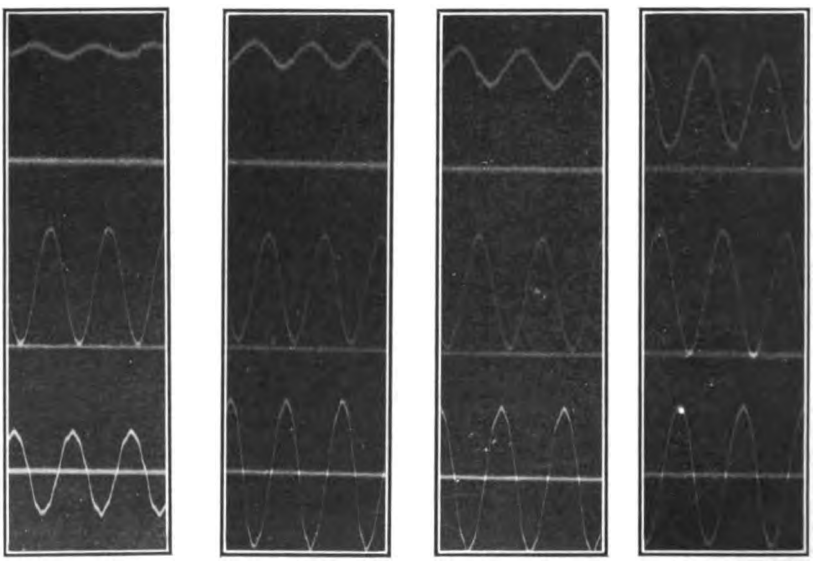



*Fig. 9—Curves obtained from test showing sensitiveness of alternator voltage control with different series condensers*




| 0 μ F. | 1 μ F. | 0.33 μ F. | 0.125 μ F. |
|---|---|---|---|
| 31.5 | 52. | 70.5 | 120 |

*Fig. 10—Oscillograms showing ratio of amplification with different series condensers*

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difference between the inductive reactance of the amplifier coil and the capacity reactance of the series condenser. The smaller this difference, the lower will be the amplifier excitation that gives minimum impedance and the corresponding minimum of the alternator voltage. This means that the sensitiveness of the amplifier is increased because a smaller excitation is needed to reduce the alternator voltage. The increase of sensitiveness that can be obtained in this way is, however, not unlimited. If the minimum impedance is obtained as a result of a large inductive and a large capacitive reactance, the care loss due to hysteresis and eddy currents becomes appreciable and appears as an equivalent resistance which cannot be neutralized. Fig. 9 shows, from results of tests, the variations of alternator voltage that can be obtained by different values of series condenser and the corresponding increase of the sensitiveness of the amplifier. The sensitiveness is represented by the steepness of the curves. It can be seen from the shape of these curves that the increased sensitiveness is gained at the expense of range of control or differ-

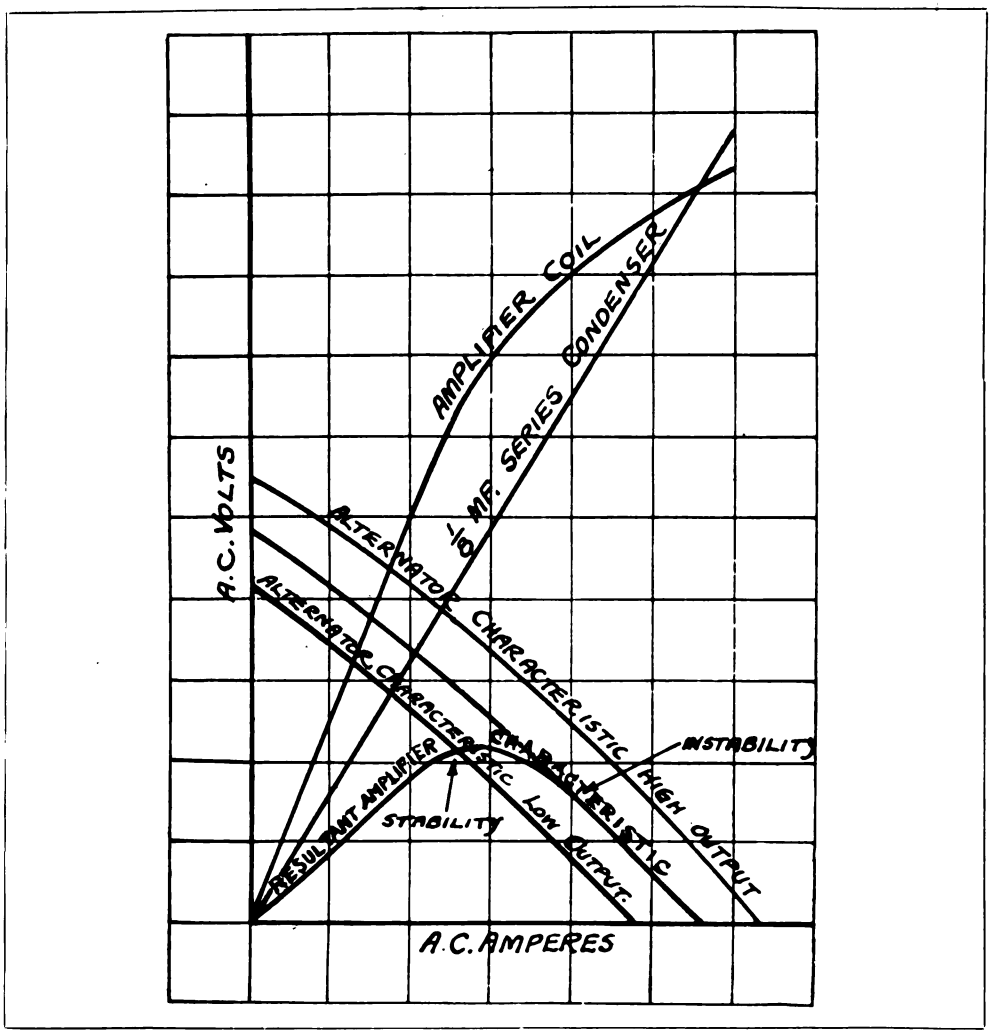


*Fig. 11—Graphic analysis of instability*

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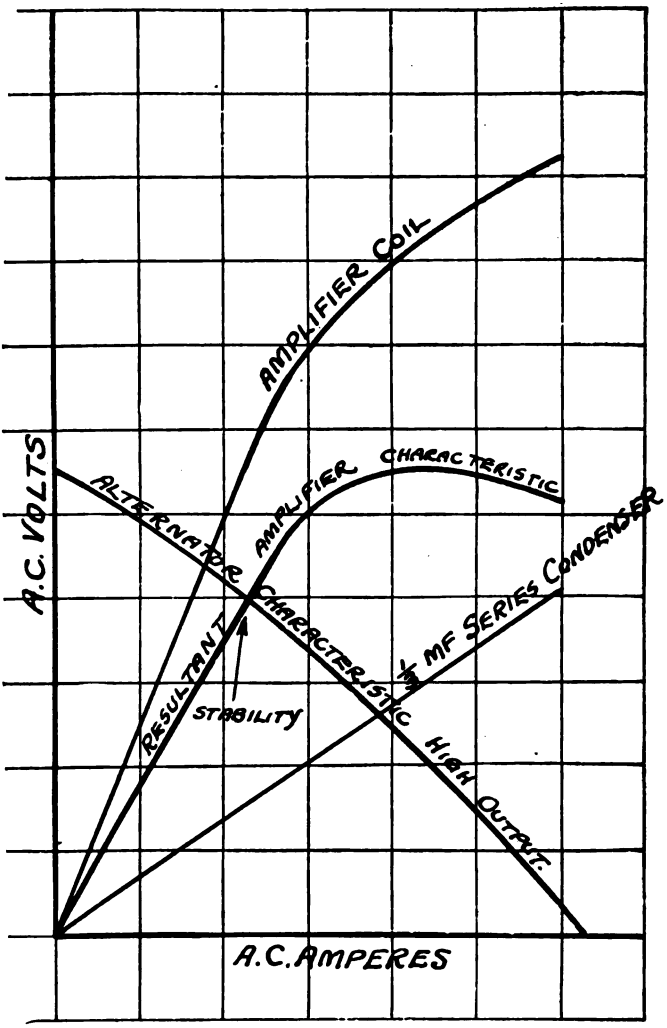


*Fig. 12—Graphic analysis of instability*

ence between maximum and minimum voltage. However, all the curves show a practically linear proportionality between excitation and voltage over almost the whole range available. The difference in sensitiveness with various series condensers is also illustrated by oscillograms, Fig. 10. The upper curve represents alternator voltage. The two lower curves represent amperes and volts, respectively, impressed upon the amplifier controlling winding, the frequency of the controlling current being 500 cycles. The effect of departure from linear proportionality and the consequent distortion of wave shape is shown in Fig. 15.

The amplification ratio is defined as the difference between the maximum and minimum kilowatts output divided by the effective alternating volt-amperes supplied to the controlling winding. The ratio of amplification can be derived directly from the oscillograms with reference to the calibration of the oscillograph curves. The ratio of amplification for operation suitable for

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telephone control ranges from 100:1 to 350:1.

### Instability

The voltage which results from the combination of alternator and amplifier can be determined as has been explained by the intersection of the alternator and amplifier characteristics. When the curves have a definite and sharp intersection point a definite alternator voltage results from each excitation of the amplifier. If, on the other hand, the curves should have such a shape that the alternator and amplifier characteristic curves become parallel in some place, the intersection becomes indefinite and the result is instability and generation of self-excited oscillations. This is a condition that must be avoided for telephone control; whereas it may have useful applications for other purposes. The conditions that lead to instability can be graphically analyzed as shown in Figs. 11 and 12. Fig. 11 corresponds to a series condenser of 1/8 μf. (microfarad) which leads to instability at higher generator outputs; whereas, Fig. 12 corresponds to a series condenser of 1/3 μf. and represents a condition which is stable for all voltages at which the generator can be operated. The upper curve in each diagram is the volt-ampere curve of the amplifier coil and the straight line through the origin represents the series condenser. The lower curve is the difference between the volts amplifier coil and volts series condenser, which is for the present purpose a sufficiently close approximation of the volt-ampere curve of the combination. This resultant volt-ampere curve in the left hand diagram rises to a maximum, then falls again and crosses the zero line. The crossing of the zero line means change from inductive to capacitive impedance.

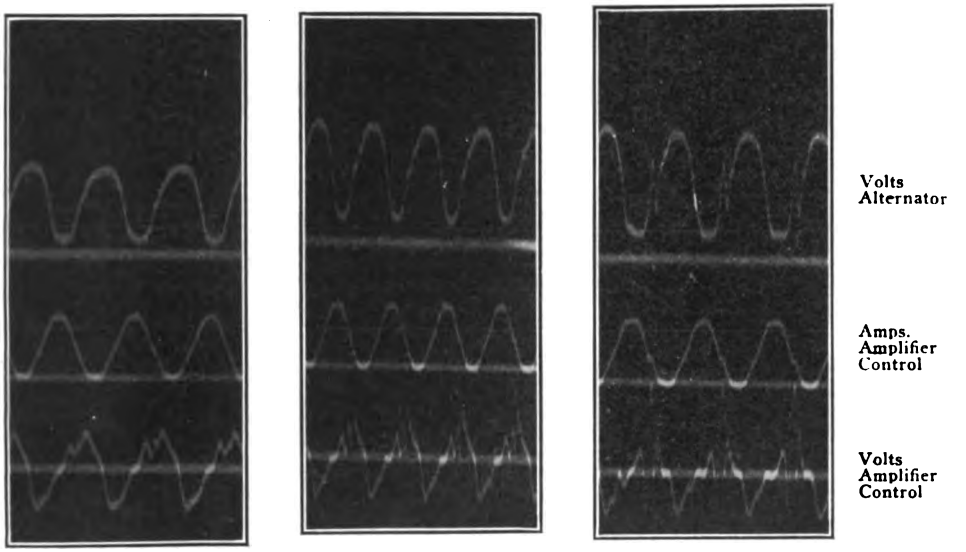


*Fig. 13—Oscillograms showing instability at higher alternator voltage*

With reference to any circuit which has a volt-ampere characteristic with a bend in it, it can be said that as long as the volt-ampere curve is rising, the circuit is stable where it is connected to a source of constant potential, and wherever the volt-ampere curve is drooping, the circuit is unstable on a constant potential. The rising part of the curve corresponds to a positive resistance and the drooping side to a negative resistance. Well-known types of negative resistance are electric arcs or series commutator generators. A circuit of this character is stable only when operated on a source of potential which has characteristics equally or more drooping than the drooping volt-

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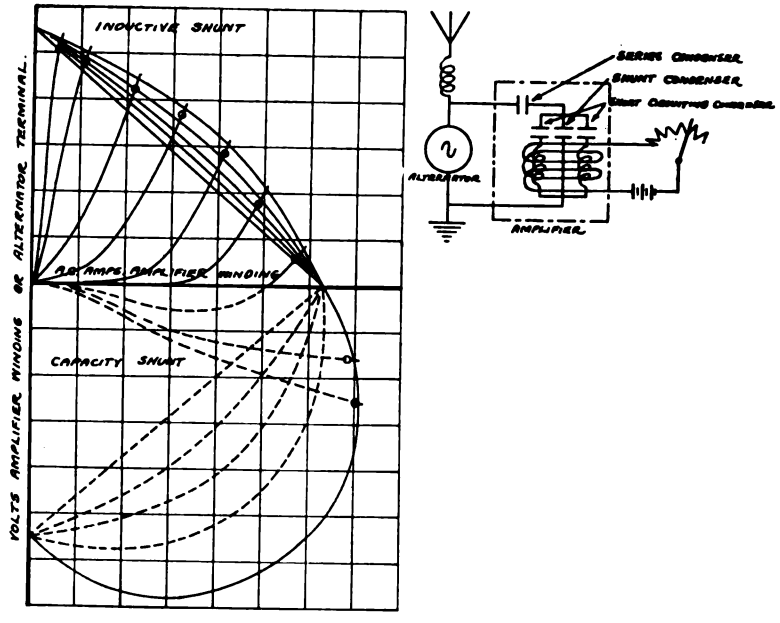


*Fig. 14—Volt-ampere characteristics of amplifier with shunt and series condenser showing intersection with alternator characteristics*

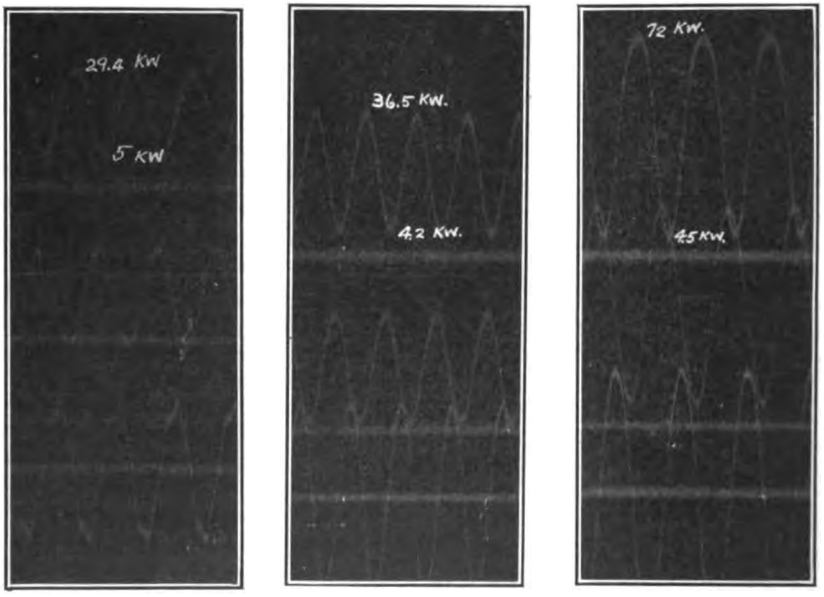


*Fig. 15—Oscillograms showing effect of different shunt condensers*

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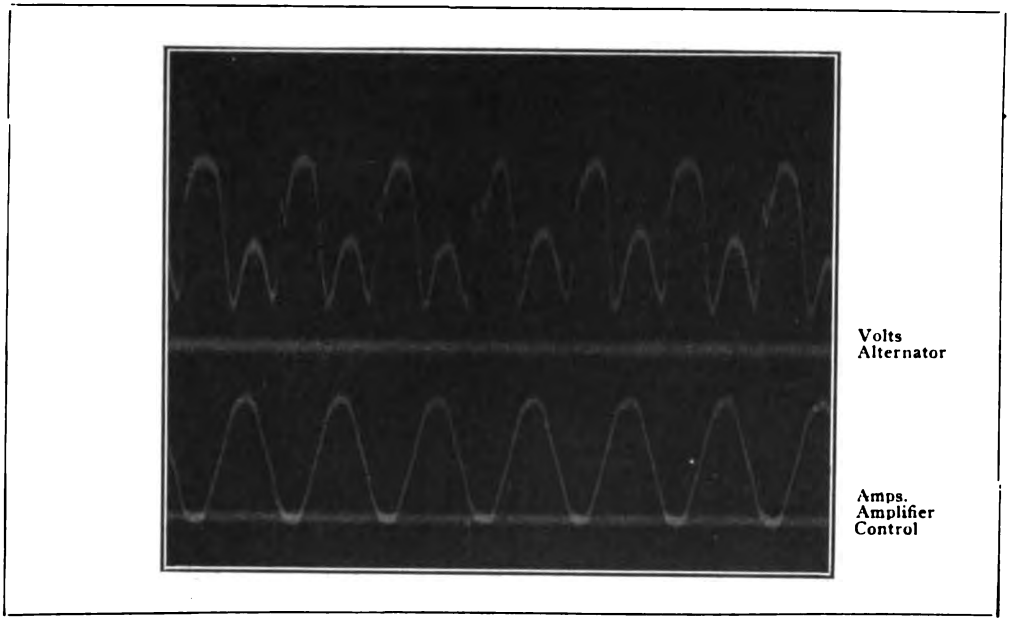


*Fig. 16—Oscillogram showing distortion where range of linear proportionality of control is exceeded*

ampere curve. These same curves (Figs. 11 and 12) show the volt-ampere characteristics of the alternator. In Fig. 12, the resultant characteristic is only slightly drooping at the end, whereas, in Fig. 11 the condition for instability is indicated by the place where the volt-ampere curve of the amplifier is more drooping than the volt-ampere curve of the alternator. Fig. 11 also shows that the alternator curve corresponding to low output intersects the amplifier curve at the stable portion and the characteristics for increased output reach the unstable portion of the resultant amplifier curve. This change from stability to instability is shown by the series of oscillograms in Fig. 13. The instability, as shown by the self-excited oscillations re-occur at the same place of the wave which is the point at which the characteristic curves are tangent, as shown in Figs. 11 and 12.

### Shunt Condenser

A further improvement in sensitiveness can be obtained by using a combination of shunt and series condenser. The shunt condenser is so proportioned as to make the amplifier take leading instead of lagging current at low excitation. Complete characteristic curves of the amplifier with shunt and series condenser and the superimposed alternator characteristics are shown in Fig. 14. The series of oscillograms (Fig. 15) show the effect of different amounts of shunt condenser. While the series condenser is used within the limits of stability to increase the sensitiveness, the shunt condenser has the object of allowing the alternator to assume its full maximum voltage. The last oscillogram (Fig. 15) shows an alternator output of 72 kilowatts.

### Applications of the Amplifier

The oscillograms of Fig. 17 shows telephone control of the alternator output. The two curves on the oscillogram, which curves are relatively upside down, show that the variation of the alternator voltage is in all details an almost exact reproduction of the controlling telephone current.

While a specific method of adapting the magnetic amplifier to an alternator as described above has been worked out both theoretically and experimentally in greater detail, there are obvi-

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ously a variety of possibilities of adapting the same devices and theories to other conditions. Outside of telephony, the magnetic amplifier will probably be found of value as a non-arcing key for telegraphy, and particularly will make possible high speed telegraphy at the same rate and with the same means as high speed automatic telegraphy on land lines. Oscillograph records have been taken of telegraphic control transmitting from 500 to 1,500 words per minute.

The structure and the mode of operation of the magnetic amplifier which has been described in such that there appears to be no limit to the power that might be controlled in this way if the apparatus is designed with suitable dimensions. The 72 kilowatt control which has been demonstrated may be sufficient for most purposes, but there would be nothing surprising if several times this amount of energy were to be used in trans-Atlantic radio telephony or high speed telegraphy in order to make the service thoroughly reliable.

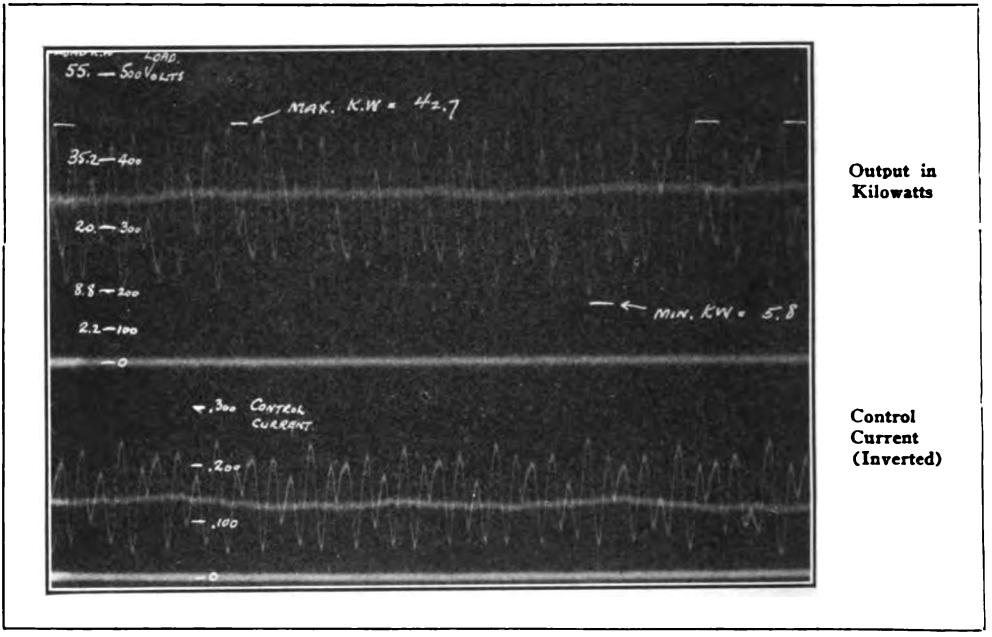


*Fig. 17—Oscillograms showing telephone control*

### Sending Aid to Shackleton Expedition

A wireless despatch recently received from the Shackleton Antarctic expedition's auxiliary ship Aurora, reported the vessel as 250 miles southwest of Port Chalmers, New Zealand. The despatch said:

"We are setting toward Snares Islands under the influence of wind and sea. We are unable to manœuvre the ship owing to damage to the jury rudder."

A further wireless message from the Aurora received later said:

"We are now sailing at the rate of three knots. All well."

The authorities sent a tug to the assistance of the Aurora.

### Emergency Lighting System

An emergency lighting system for steamships has been announced by the United States Bureau of Navigation. The invention is the work of R. Y. Cadmus, radio inspector at Baltimore. It is designed to furnish light in case of accident while the passengers are being removed. Power is furnished by the plant for the auxiliary wireless system. On a sinking ship the general lighting plant is submerged soon after the vessel begins to go down, but by means of Mr. Cadmus's invention the upper decks will still be illuminated long after the engine room is under water.

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# The Flatbush Signal Corps

## Some Details of the Military Organization Created Largely Through the Efforts of One Man and a Few Suggestions for Establishing Similar Corps for the Third Line of Defense

OF special interest to readers of this magazine, because of its affiliation with the National Amateur Wireless Association, is the Flatbush Signal Corps, which is making an enviable record and securing recognition which extends far beyond the immediate vicinity of its headquarters. This organization, attached to St. Stephen's Church in the Flatbush section of New York, is commanded by Captain George H. Smith, formerly in the U. S. Navy, also the First Battalion Signal Corps, N. G., N. Y., and a member of the Military Committee of the National Amateur Wireless Association. At present there are sixty-five members, all uniformed and fully equipped.

*The Signal Corps operating portable field apparatus*

Clubs and individual members of the Association who are planning or already organizing signal corps units for the nation's third line of defense will find that in many respects, the regulations which govern the Flatbush company are of value in suggesting efficiency of organization. The corps has five commissioned officers; aside from Captain Smith, already mentioned, these are: Lieutenants Griswold and Mattes, ex-captains of the American Boy Scouts; Lieutenant Lenart, corporal, 23rd Regiment, N. G., N. Y., and Rev. L. D. Gable, chaplain, with rank as first lieutenant.

The recent rapid enrollment of new members has made necessary dividing the corps into three platoons for drill purposes, but the early work of the year was conducted with two-platoon

***This photograph** shows the members of the corps equipped and in marching order*



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*The reel cart pictured here carries a quarter-mile of double twisted buzzer wire*

formation, under command of Lieutenants Griswold and Lenart. The company holds weekly drills, on Friday nights, and at the beginning of the season devoted the first three sessions to company drill by squad and full assembly. Commencing with the fourth week, the captain and the lieutenants each took command of a section of twelve members and simultaneously gave instruction in two classes of visual and electrical signaling. That is, on the same evening, the first section received instruction in semaphore, the second in wireless, the third in wig-wag, the fourth with the buzzer. The following week the assignment of subjects was altered to give each section instruction in another branch of the work, and so on through thirty-six drill nights; in this way all of the members are taught every branch of the signal service. The manual of the pistol and flag, field telephony, night signaling by semaphore and flashlight, drill with the searchlight, first aid, and whistle and bugle signals, are some of the other subjects in which every member is required to perfect himself.

The varied system of instruction not only makes for individual and company efficiency in this case, but insures an unusually high percentage of attendance. The records show that the absentees have never run over three out of the entire company, and then only when some special condition at home prevented a member's attendance. The rules and regulations provide for fines up to fifty cents for delinquency. Those who absent themselves for more than two weeks are summoned to appear before a court-martial, and if they do not appear, are dropped from the corps.

Securing members has been the least of the problem. The corps was started with twenty-two on the roster, and every Friday night since, Captain Smith has found it difficult to take care of the new applicants for enrollment. The officers whom he has appointed are experienced

*In this photograph the members of the corps are shown in the wig-wag drill*



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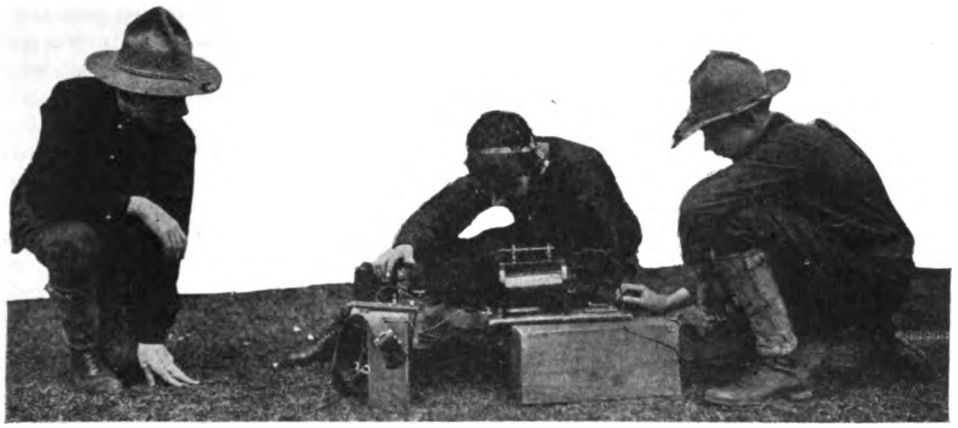
cadet and militia instructors, and all promotions are made by strict competitive examinations embracing all the subjects in which instruction has been given. Members pay dues of five cents each week and supply their own uniforms, costing $2.50 complete. The technical equipment used by the company is valued at about $250 and has been acquired through donation or paid for out of dues.

Everything essential to practical instruction has been acquired under this system. The corps has wig-wag and semaphore flags for each member, a searchlight and lamp semaphore for visual night signaling; a set of national colors and a guidon, as well as full camp equipment, comprising cooking utensils, tins and knives and forks. The technical apparatus includes a reel cart with a quarter-mile of double-twisted buzzer wire, a pike and ground spikes for laying the wire, tools such as hammer, pliers and hatchet, two field buzzers, boxed, with batteries, keys and straps attached, and two field telephones. The wireless transmitting and receiving apparatus used at present is described as merely a short-range practice set, purchased out of existing funds and to be replaced later by field apparatus with a ten-mile range. The transmitting set is contained in a box carried by shoulder strap and comprises ½-inch coil, zinc spark gap, single circuit telegraph key and sending condenser. The receiving set, also made in portable form, has a bare wire-wound tuning coil, galena detector and 500-ohm phones. It is at once obvious that the range of this apparatus is limited, yet sufficient for practice and drills. The mast equipment is excellent. Six 4-foot sections with guys and connecting straps attached are easily carried over the shoulders of two of the members, allowing two 12-foot masts and 200 feet of antenna wire to be easily transported and quickly erected anywhere. Twenty dry battery cells and a battery ammeter complete the technical equipment.

Every member of the corps is required to become thoroughly familiar with signaling of all classes, as well as to learn the ceremonies drill and field maneuvering. A company review is planned before the close of the indoor drill season and the company will have a place in the New York Memorial Day Parade. Outdoor work already scheduled includes a visit to a nearby fort and a summer camp over the holidays.



*The portable wireless set used in the exercise of tactics*

Serving as a pattern for newly created signal corps companies, the Flatbush organization illustrates what may be accomplished in a short time with proper supervision by experienced instructors. The members are absorbed in their work of preparation for possible emergency and friendly rivalry in the branches of military efficiency and take part in the close contests in the basketball series played between teams organized in the various units of the corps. National

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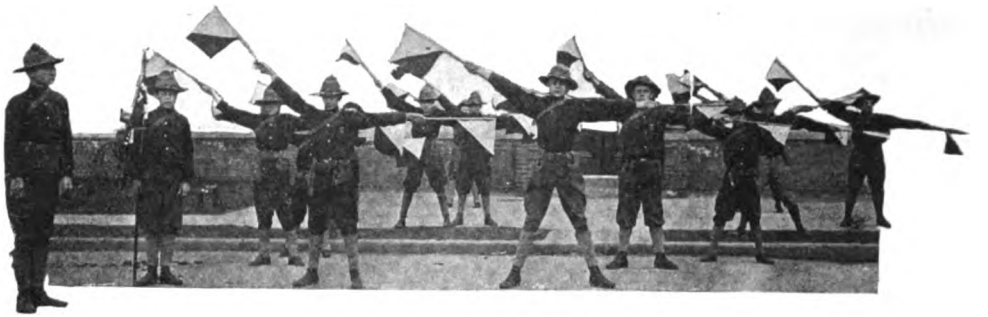

*A semaphore drill. The corps has lamps for visual night signalling*

Guardsmen are taking special interest in the corps and several officers high in the State service have inspected the organization and given it unqualified approval and support.

Captain Smith, who is on the Military Committee of the National Amateur Wireless Association, and is assisting in the preparation of the plans for nation-wide organization which are being carefully worked out at headquarters, has expressed his willingness to give further details to those who are interested in joining the corps with a view toward building up to a full battalion.

## THE WIRLESS AND THE CABLE

The volume of traffic dealt with by cable companies, says "The Year-Book of Wireless Telegraphy and Telephony," depends not merely on atmospheric and other conditions, but also upon the traffice capacity of each cable. Only a certain number of words can be transmitted per minute and it often happens when lower rates or other reasons conduce to heavy increases in the volume of business, the existing cables become "blocked" thereby. If the increase in the volume of business is maintained, there is no other solution but laying additional cable, a matter of great expense and delay. With wireless operation, on the other hand, improvements in apparatus and increase in power permit of dealing with increased business, over and above its existing capacity, at comparatively little increase in expense, and with far less delay in point of time. The old objection with regard to continuity of service has practically disappeared before the improvements made in recent years.

We sometimes hear of objections raised to wireless transmission on account of the fact that messages sent can, without much difficulty be picked up by any receiving stations capable of being tuned for the purpose within the radius of transmission. Cable advocates point with pride to their own potentialities of secrecy. Careful analysis of the situation hardly justifies this claim of superiority. It is obvious that, in by far the greater number of instances, messages picked up by persons whom they do not concern will receive little consideration. Anyone who, for commercial or other reasons, is directly interested in acquiring knowledge of the messages sent would be equally likely to be able to gain such knowledge even if the messages were dispatched by cable, although at a little further expenditure of trouble. But, if the motive of self-interest were at work, the extra trouble would be a matter of little moment. The cable companies have to work in connection with land-lines and these latter are almost as easily tapped as wireless transmissions. The only reliable method of attaining secrecy is by the use of codes and these may be as effectively employed in wireless as in wire transmission.



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# With the Amateurs

THE troubles of a Texas amateur operator in these days of punitive expeditions are well illustrated by the following letter received by David Harrell, secretary of the Austin Radio Club:

Headquarters Southern Department,
Fort Sam Houston, Texas.

DEAR SIR:

Information has reached the Commanding General, Southern Department, to the effect that you are equipped with receiving and sending instruments for wireless telegraphy, and he directs me to communicate with you and to request that you make use of the enclosed penalty envelope, which requires no stamp, to inform this office in the event this information is correct that you have immediately dismantled this apparatus, and that you agree to make no further use of it until such time as you may be informed by these headquarters that its use by you will no longer be considered in violation of Federal law.

It is also requested that you furnish these headquarters with a list of names and addresses of any other amateur operators in your vicinity whom you know, in order that similar instructions may be furnished to them.

The Department Commander further directs me to inform you that unless prompt action as requested results from this communication, the matter will be placed in the hands of the United States Secret Service authorities and steps taken by the United States District Court to enforce what is herein requested.

Respectfully,
MAX BUNDY,
Colonel, Adjutant General, Department Adjutant.

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The Colorado Wireless Association of Denver has, since its organization last October, established some enviable receiving records, including NAU (Porto Rico), NAW (Cuba), KIE and KHX (Hawaii), NPR, NPV and NPS in Alaska, NAX, NPJ and NBA at Panama and OUI and POZ in Germany. The station is equipped with a vacuum valve detector, two 1 k.w. rotary quenched gap sets, a two-step amplifier and tuning inductance for receiving waves from 200 meters to 20,000. The aerial is 400 feet long, 150 feet high, composed of six strands of No. 12 aluminum wire on twenty-foot spreaders. The association station (KIX) has a limited commercial license to work with Victor, Colorado (KIW), and also transmits time signals every night at ten o'clock, mountain time.

Signals are received from NAA, NAR and NPH. The signals from NPH vary greatly from the Arlington signals, sometimes being as much as four seconds slow, while the signals from Key West hardly ever lag more than three-tenths of a second behind Arlington. Several times members have heard both the signal and compensating wave of Arlington's Poulsen transmitter when using a very sensitive galena detector.

The association conforms in many details with the suggestions given in the book "How to Conduct a Radio Club."

---

The Essex County Wireless Association of Beverley, Mass., is developing into a thriving club and already has half a hundred members. One of the interesting departments the club has formed is a question and answer department by means of a card index system. This index will hold information sufficient to answer any one of a thousand questions, indexed in such a manner that if any member asks a question the desired information can be found in almost a second's time.

Membership in the association is open to anyone interested in wireless



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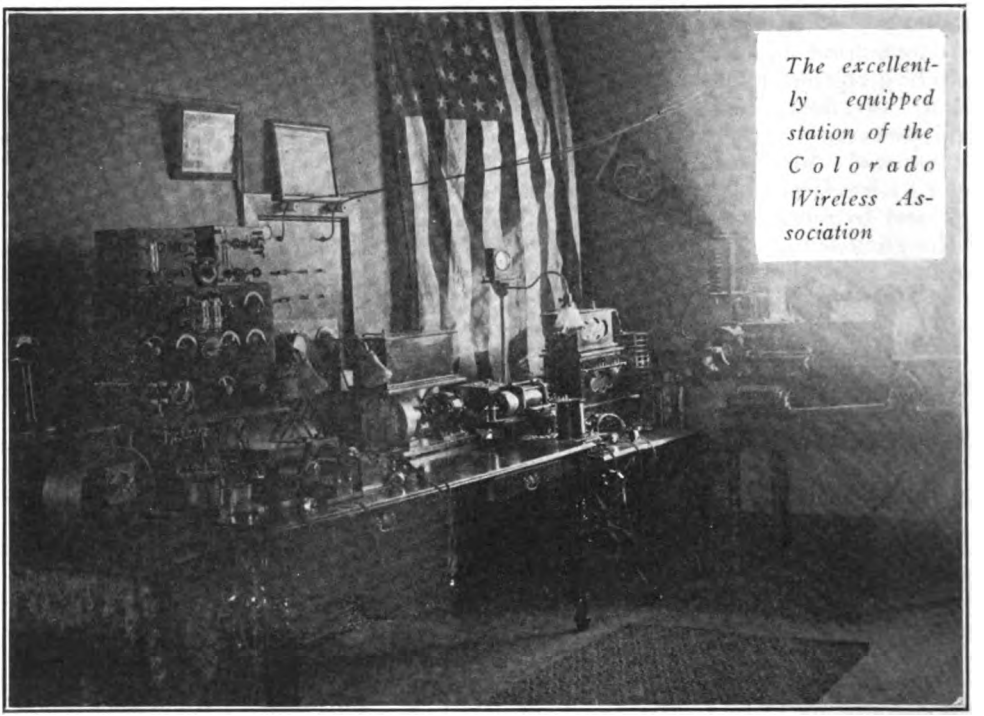
or electricity. An honorary member, says its constitution, shall be a person of recognized ability or one who has rendered service to the radio field and to the club.

An interesting section of the constitution is as follows:

"Any member found guilty of violating the radio laws which the United States has made or is a party to such violation shall be expelled from membership."

work was done on the evening of December 31, when a New Year's message was relayed from St. Louis to St. Paul, where it was delivered to the new governor of Minnesota. The Washington's Birthday message started from one of the association's star stations, 9XE.

Another important feature is the attempt to control interference. This attempt will be made through proper organization. The officers have an ex-



*The excellently equipped station of the Colorado Wireless Association*

The Mississippi Valley Wireless Association, of Dubuque, Ia., which was recently organized, has for its officers: President, A. S. Blatterman, St. Louis, Mo.; vice-president, D. C. O'Neil, St. Louis, Mo.; secretary, J. D. Brennan, Dubuque, Ia.; treasurer, E. C. Fawkes. The association has a board of six directors.

The primary object of this organization is to establish a reliable intercommunicating club or a chain among the members. Relaying is to be an important feature. The first of this

cellent plan which they think will work.

An interesting bulletin is sent out semi-monthly for the benefit of the members.

This organization consists of the states in the Mississippi Valley and all of the wireless operators in these states are invited to join. The annual dues are fifty cents, which go to cover the cost of the bulletin, postage, applications, etc. Application blanks may be had by sending to the secretary, J. D. Brennan, No. 501 Alpine street, Dubuque, Ia. As a list of stations are to

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be published soon it is desired that all interested send for the blanks at once. The list of stations will be sent to the members free of charge.

---

The San Francisco Radio Club has been organized with fifteen charter members. The officers are as follows: President, A. W. Martin; vice-president, F. G. Taylor; secretary and treasurer, William Griffith; corresponding secretary, Thomas J. Ryan; sergeant-at-arms, C. P. Altland; radio police officer, Edward M. Sargent. Anyone wishing information concerning the club should address the corresponding secretary, Thomas Ryan, No. 82 Downey street, San Francisco, Cal.

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The amateurs of Portland, Maine, have formed the Portland Radio Association. Their first meeting was held on January 4, and on March 7 they moved into their new club room at No. 487 Congress street. Here a 150-foot antenna has been erected, and a complete receiving set installed. The clubroom is finished in green burlap and mission. A large mission table and chairs make the room very attractive. There are thirty-one paid-up members in the association, and a number of applications are on file.

The officers of the association are: President, H. W. Castner; vice-president, W. H. Richeleau; secretary, C. T. Beardsley; treasurer, E. S. Rogers.

Various committees for managing the various branches of the club have been appointed and blackboards for descriptive lectures, practice sets, test apparatus, etc., have been installed. A committee for booking up a course of lectures for each meeting is making good headway, and promises some very interesting talks, beginning in a few weeks.

The club takes pleasure in extending an invitation to all radio men to visit the club rooms when in Portland.

---

At the January meeting of the Amateur Marconi Radio Association of Troy, N. Y., the semi-annual election of officers was held. W. W. King, W. A. LeMay, and E. M. Williams were re-elected president, vice-president and secretary, respectively, and C. E. Everingham was elected treasurer. The first anniversary meeting of the association was held in February. The principal speaker was R. B. Bourne, a former commercial operator.

At the meeting in February a system of giving practice in receiving, similar to that described in "How to Conduct a Radio Club" was put into operation. There was also a large display of the many different types of wireless instruments for amateur use. The membership has increased to about twenty. Meetings are held every other Saturday evening at the Y. M. C. A.

The association will be glad to hear from other wireless societies, and amateurs throughout the country, especially those in the West and South. Address all communications to the secretary at 1627 Seventh avenue, Troy, N. Y.

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The Connecticut Valley Radio Club of Springfield, Mass., has been granted permission to use two rooms in the Technical High School of that city and is now planning to obtain a set. At present a temporary set furnished by the forty-seven members of the club is being used.

Meetings are held every other Friday. Persons living near Springfield who are interested in wireless are invited to join the club. Further information can be obtained by addressing George Beecher, secretary, at No. 416 Allen street, Springfield, Mass.

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A group of amateurs of Buffalo, N. Y., have organized the Amateur Radio Association of Buffalo. The president, A. J. Carver, is one of the pioneer wireless men of the city. The other officers are: Vice-president, Norman Badina; treasurer, Francis Adams; recording secretary, H. E. Wilkinson; corresponding secretary, Newton J. Frank; sergeant-at-arms, Otis Boowen. Correspondence should be addressed to the secretary at No. 411 Humbolt Parkway, Buffalo, N. Y.

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The Harvard Wireless Club is a reorganization of a club of the same name which existed at the University several years ago, but which has been inactive for some time. It was reorganized in the early winter of 1915, and now has a good membership and a first-class wireless station.

This station is in the club room in the basement of the Harvard Union, where the business of the club is conducted. It is the custom to have some one prominent in the radio field address club meetings. There are ample facilities for amateurs to learn the code.

The transmitting instruments comprise a ½ k.w. transformer, four condensers, two oscillation transformers, and two short wave condensers. The receiving equipment is composed of a vacuum valve transformer panel set loaned by one of the members of the club, and a long wave receiving transformer.

Both Berlin and Hanover are received regularly, and other stations in America, from Canada to Panama, are copied. The club carries on regular communication with ICM (Laconia, N. H.), and has been heard by 3NB (Vineland, N. J.), and by 8ZW (Wheeling, W. Va.). The last-named station is over 500 miles away, giving the club a record of over one mile per watt.

The club is planning to hold a large open meeting, which will probably be addressed by an army officer.

The officers of the club are: Permanent president, Professor George W. Pierce; manager, E. B. Dallin; secretary, E. F. Henderson. The secretary will be glad to receive letters from presidents of other radio clubs or others interested.

*Listening to Panama in Cambridge, Mass. The operating set at the* ***Harvard Wireless Club***

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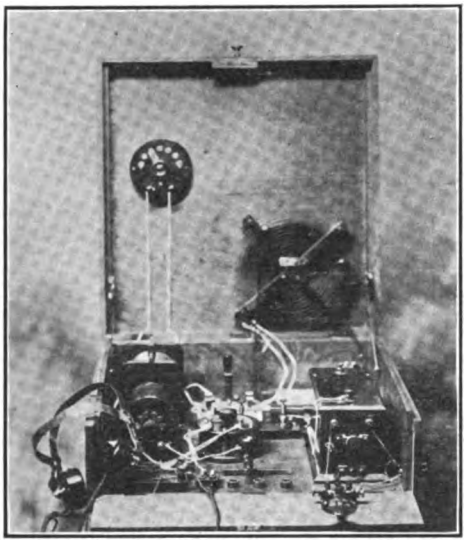
An accompanying illustration shows a very compact portable wireless outfit mounted in a specially designed, quarter-sawed oak case, made by Darrel J. Cyr, of Sioux City, Ia.

From left to right the outfit consists of: A loose coupler with a fixed condenser placed beside it; a twenty-three-plate variable condenser, a three-cup detector (the bracket being on a rod so as to slide to the different minerals, which are galena, silicon and molybdenite), a fixed spark-gap; a 2-inch spark coil and a moulded sending condenser back of it. The key is on the hinged front, which drops on pegs so that it is level. The helix is fastened on the cover.

The aerial switch is seen in the rear center. A 3,000-ohm head set is shown in the picture. The 5,000-meter loading coil has recently been placed in the case. The aerial consists of six wires, spaced 18 inches apart, in the shape of a V. When it is hung on 18-foot poles on top of a house 35 feet high, NAA, WSL and other stations can be heard.



*Darrel J. Cyr's portable apparatus*

Mr. Cyr is a member of the Central Radio Association and the National Amateur Wireless Association. His call letters are 9TO.

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The regular meeting of the Cedar Wireless Association of Cedar Rapids, Iowa, was held on March 30 at the Y. M. C. A. Committees on social and executive affairs were appointed. After the business meeting a treatise relating to wireless transmission and interference was read.

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A class of instruction has been formed by the Inter-City Radio Association of Allentown, Pa. Persons desiring information in reference to the association should communicate with D. H. Goodling, No. 330 North Madison street, Allentown, Pa.

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Wireless messages from the United States punitive expedition's field station in Mexico have been heard by the licensed amateur operators of Austin, Texas. While none of the messages can be given out, David Harrell, Jr., a licensed amateur operator, said that he could catch the messages as they were flashed across the border.

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J. A. McKay, Salt Lake Route operator at Milford, Utah; J. G. McCullom, No. 942 Harvard avenue, and J. L. Lundberg, No. 70 P street, of Salt Lake, were among the hundreds who received the news of the Willard-Moran fight by wireless telegraphy.

The news was flashed through the air by S. H. Besley, No. 171 East Seventh South, who had his instruments located in the rooms of the Salt Lake Transportation Club in the Keith building.

Within a few seconds after the result of the fight was announced, Mr. Besley was sending the news to those with whom he was in communication. A few minutes later he told them the story of the fight by rounds.

---

The New London (Conn.) Radio Club has been organized with the following officers: President, Wesley Bradshaw; vice-president, Acors B. Boss; secretary and treasurer, Paul Tilden. At present the club has eighteen members, of whom twelve either hold or have applied for amateur licenses. The club's headquarters are in the New London Y. M. C. A.

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The Sacramento Radio Club, of Sacramento, Cal., was organized recently with a charter membership of eleven. Meetings are held every second Wednesday of each month. These meetings are held at the homes of the club members, but it is hoped to obtain a room at the local Y. M. C. A.

The club is taking the initiative in forming a relay league with amateurs throughout the Sacramento Valley. This league will be instrumental in relaying flood and weather reports to the state reclamation headquarters. The officers of the club are: President, Carl Schoefer; vice-president H. Stevens; secretary, Rad Coover, and treasurer, Carleton Flint. Anyone desiring particulars about the club can obtain them by writing the secretary at 1613 Nineteenth street, Sacramento.

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The Hoosier Radio Club of Indianapolis, Ind., has been reorganized and the following officers elected: President, R. C. Kennan; vice-president, N. Hilgenberg; secretary, N. Watson; treasurer, B. K. Elliott.

All Indiana amateurs are requested to send their names and addresses to N. Watson, No. 204 N. Hamilton avenue, Indianapolis, Ind. The Hoosier Radio Relay Chain is to be formed throughout the state and all amateurs, regardless of equipment, are needed.

Attention is also called to the fact that any amateur having difficulty in the operation of his apparatus can secure the advice of the best radio men in the state by addressing the secretary and enclosing return postage.

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The St. Louis (Mo.) Radio Club has taken up quarters at the Y. M. C. A. building. The following officers have been elected: President, H. Blatterman; vice-president, W. Boelsing; secretary, F. Best; treasurer, W. Russell; station inspector, L. Benson. Correspondence with individuals and other clubs is invited. Correspondence should be addressed to Fred Best, No. 4104 Easton avenue, St. Louis.

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At a meeting held on March 10, the Oklahoma Radio Experimental Association of Oklahoma City, elected the following officers: President, Kenneth Ehret; vice-president, Harry Cole; secretary-treasurer, Clifford A. Smith; business manager, Keith Danvers. The association has twenty-five members, and expects to double the membership within the next six months. Meetings are held every two weeks and copies of the papers read are sent to the branch clubs in other parts of the state of Oklahoma. All amateurs in Oklahoma are invited to join the association. Correspondence should be addressed to the secretary at No. 922½ W. Main street, Oklahoma City.

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The Hawkeye Radio Association was organized over one year ago by amateurs in Ames, Iowa. Since that time it has worked to promote the interests of wireless in Iowa. Every person who owns or operates a station and can work at the rate of five words per minute may become a member.

At present organized relay work is being planned. The association has gained recognition from all of the national relay organizations. To aid this work a directory is being made of all Iowa amateurs.

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Under the leadership of Professor A. N. Goldsmith, the editor of the "I. R. E.," a radio club composed of about forty students of the College of the City of New York has been organized. At a meeting held February 24, a constitution was adopted and an election of officers held.

The following were elected: President, Joseph D. Fried; vice-president, Edward T. Dickey; secretary, Herbert Kayser; treasurer, Moses Buchbinder.

Professor Goldsmith has allowed the members of the club the use of the wireless laboratory of the college, which contains the most modern types of apparatus.

Practice sets have been constructed and under the instruction of Professor Goldsmith it is expected that the members will greatly improve their knowledge of radio communication.

Letters should be addressed to the secretary, Herbert Kayser, 41 Convent avenue, New York.

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The Y. M. C. A. Radio Club has been organized at the East Side Branch Y. M. C. A., East 86th street, New York. The first meeting of the club was held on December 11, 1915. William Bohn, director of the Y. M. C. A. telegraph school, addressed the amateurs and commercial men present, and offered suggestions as to how the club should be organized. The officers elected that evening were: Representative of the Y. M. C. A., William Bohn; president and chief operator, S. A. Barone; secretary, J. D. Blasi; treasurer, Frank Hayes.

The club was organized for the purpose of bringing the amateurs into closer contact with each other; to conduct research work; discuss difficulties encountered by members and establish a wireless relay league systems between all Y. M. C. A.

For this purpose the installation of a high-power transmitting set is under way at the present time. This will be loaned to the club by the Y. M. C. A. Telegraph School, and will have its own motor-generator. It is a complete 1 k.w. transmitting equipment with a non-synchronous rotary gap.

The club also has under construction an efficient receiving set, which includes the latest vacuum valve devices. In addition, it is considering the installation of a receiving set of high wave-length for the reception of undamped oscillations. Distances of more than 5,000 miles have been received.

The station referred to will maintain a constant watch every night between half-past seven and half-past nine o'clock. It will have three competent operators on duty at each watch. Messages for persons in the Y. M. C. A. will be transmitted, but their delivery will not be assured unless directed to another Y. M. C. A. of the league. The club will help equip other Y. M. C. A.'s wishing to join the league.

All interested should communicate with William Bohn, East Side Branch Y. M. C. A., New York City.

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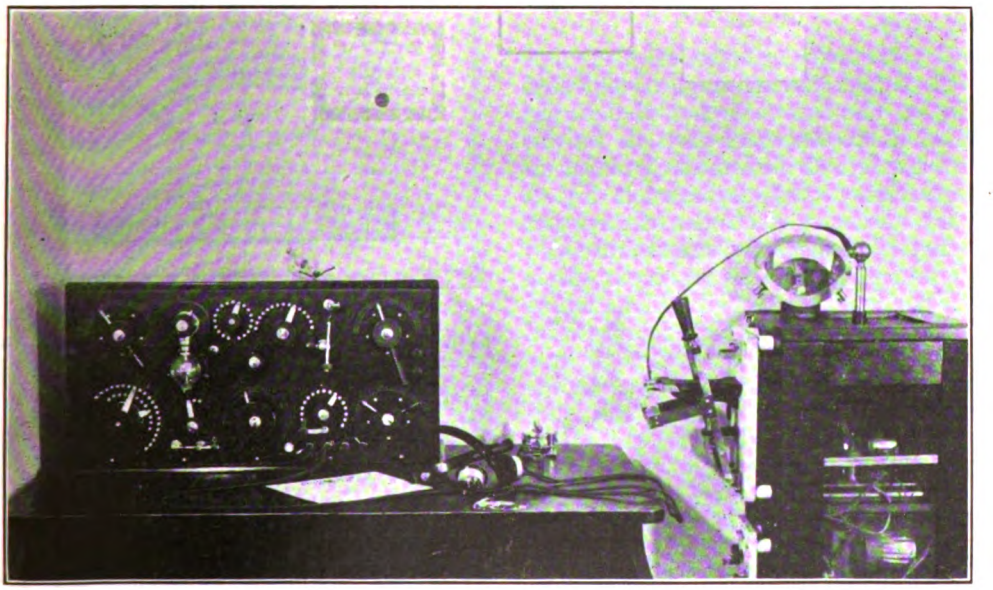
From D. R. Simmons, of Shreveport, Louisiana, THE WIRELESS AGE received a photograph of his well equipped wireless station, published on this page. Mr. Simmons writes that he can hear amateurs within a radius of 1,000 miles. With the exception of the vacuum valve detector, the entire set was made by the owner, whose call letters are 5AX.



*A wireless station of considerable merit built by D. R. Simmons*

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# From and For those who help themselves

## Experimenters' Experiences.

*The editor of this department will give preferential attention to contributions containing full constructional details, in addition to drawings.*

### FIRST PRIZE, TEN DOLLARS

### The Constructional Details of a Non-Synchronous Rotary Spark Gap

The details given in the accompanying figures cover the construction of a rotary spark gap of a non-synchronous type, which may be driven by an A. C. or D. C. motor. This gap is patterned somewhat after that type employed by the Marconi Company and will give a clear and pleasing musical note if adjusted to the proper speed. It is to be especially noted that the rotor consists of a piece of hard rubber, mounted on the shaft of the motor, which supports two brass spark electrodes. These electrodes are connected together by a thin piece of brass strip.

The stationary electrodes are supported on the bakelite ring, as indicated in Fig. 5. The circumference of this ring is divided into ten equal parts, as shown, where a hole is drilled and tapped for an 8/32 machine screw, as shown in Fig. 1. For the stationary electrodes of the spark gap, ten 8/32 machine screws, threaded their entire length are required. It is also clear from the drawing that each of the machine screws is locked in position on the bakelite ring by means of two nuts, one on the inside and one on the outside. When the electrodes are properly placed in position, projecting to equal distances around the entire ring, each set of five should be connected together by means of a piece of copper wire or preferably by a thin piece of brass or copper strip.

The details of the rotor are given in Figs. 2 and 3. The arm is made of hard rubber, which must be made perfectly true or execssive vibration will be set up. The drawing gives precise measurements for the details and shows exactly where the holes should be drilled and tapped.

A spark point for the rotor is indicated in Fig. 3; two are required. A ¾-inch piece of 3/16-inch round brass rod is obtained and threaded to within ¼ of an inch of the end. The end that is not threaded should have the edges rounded to prevent brush discharge.

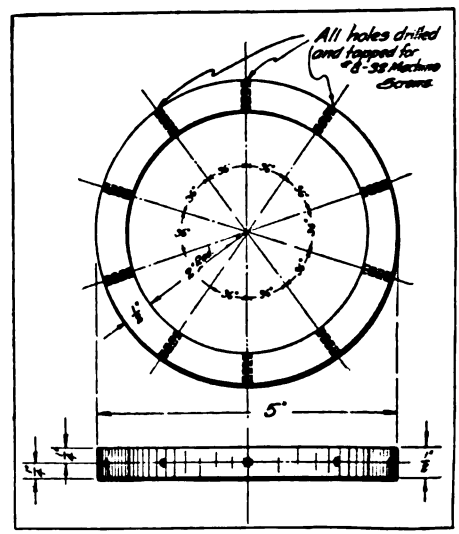


*Fig. 1, First Prize Article*

A thin brass strip connects the two spark electrodes on the rotor. The ends are bent ⅜ of an inch from the end to form an angle to bend around the



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rotor on the opposite side to which the set screw is placed. Then the spark points are screwed into the ends of the rotor (item 2), as shown in

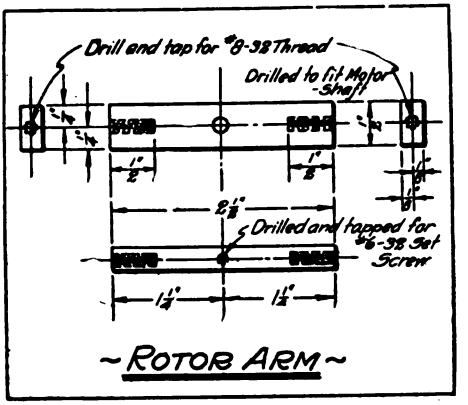


*Fig. 2, First Prize Article*

Fig 5, after which it is mounted on the rotor shaft.

The brass posts which hold the bakelite ring are indicated in Fig. 4 and need no comprehensive description as the drawing is clear and the actual length of the posts must be left to the decision of the builder, as it will vary with various types of driving motors. Fig. 5 gives a clear idea of the assembly of one-half of the rotary gap. The con-

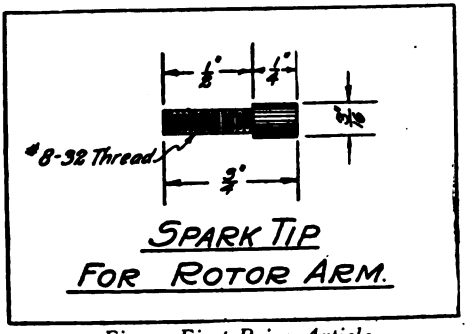


*Fig. 3, First Prize Article*

struction of the base and other small details must be left to the maker.

With a gap of this type it is essential that the driving motor be well insulated from the gap proper and that the power leads from the main line to the motor be placed at right angles to the high frequency circuits of the radio transmitter to prevent burnouts. It is still better to connect protective devices to the circuits of the motor or to mount the motor inside of a metal box, which is positively connected to the earth. In this manner the motor is protected from the electrostatic induction of the transmitter.

A particular point in connection with this gap is that the distance between the spark points on the rotor and the stationary electrodes must be exceedingly small; in fact a gap of 1/100 of an inch

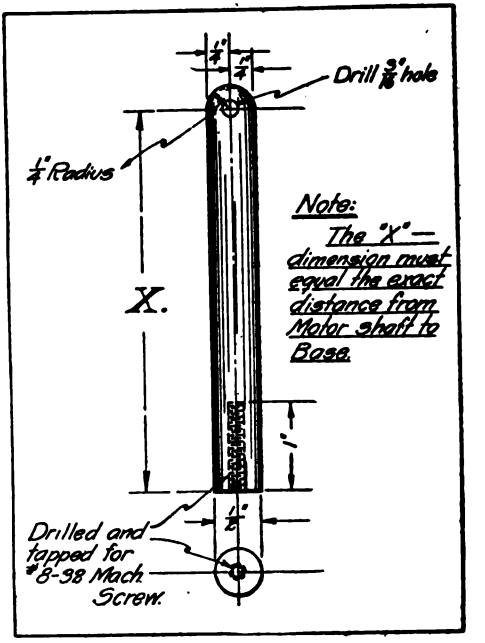
Drill 3/16" hole
1/4" Radius
X.
Note:
The "X"— dimension must equal the exact distance from Motor shaft to Base.
Drilled and tapped for #8-32 Mach Screw.

*Fig. 4, First Prize Article*

is considered sufficient. The actual quality of the note can be obtained by listening in on the head telephones of a receiving set. Careful adjustment should be made of the speed of the rotor and also of the voltage of the high potential transformer.

E. CHESTER STEPHEN, *New Jersey.*

## SECOND PRIZE, FIVE DOLLARS
### Directions Regarding How to Make a Self-Supporting Aerial Mast

About four years ago I erected a self-supporting aerial mast which has not required repairs or maintenance of any kind during this period and it appears to be in as good condition to-day as when first erected. My design does away with the unsightly guy wires of the usual mast and, in addition, the construction is economical.

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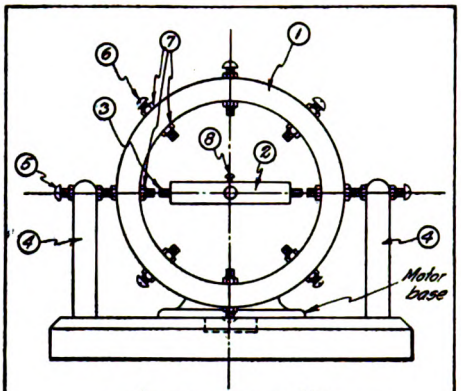
The following materials are required: Three pieces 2 inches by 3 inches by 24 feet, straight-grained white pine free from knots; one piece 6 inches by 6 inches by 6 feet, oak; four lengths of ½-inch gas pipe, each 3 feet in length, fitted with tees on one end and flanges on the other; two bolts, ⅝ of an inch by 7 inches with washers; two bolts, ⅝ of an inch by 11 inches, with washers; six carriage bolts ¼ of an inch by 3½ inches, with washers; four strain insulators; 150 feet of No. 12 galvanized iron wire; eight screw eyes with 1-inch eye; four 6-inch turnbuckles with 9¼-inch bolts; 100 feet of pine, 3 inches by 1 inch for lattice work on the lower half of the mast.



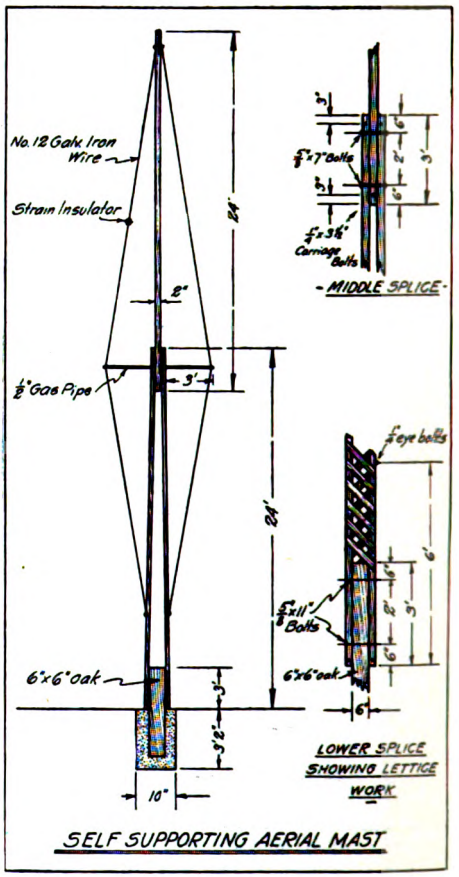

LIST OF MATERIAL

| Item | Part | Size | Material | Amt. | Fig. |
|---|---|---|---|---|---|
| 1 | Stationary Tiphalder | (see Fig 1) | Bakelite | 1 | 1 |
| 2 | Rotor Arm | ¼" x ⅛" x 2⅛" | Brass | 1 | 2 |
| 3 | Rotor Spark tip | (see fig 3) | Brass | 2 | 3 |
| 4 | Upright | (see fig 4) | Brass | 2 | 4 |
| 5 | Stud & Set Screw | 2" 8-32 R.H.M.S. | Brass | 2 | 5 |
| 6 | Stud | 1" 8-32 R.H.M.S. | Brass | 6 | 5 |
| 7 | Lock Nuts | 8-32 Hex | Brass | 20 | 5 |
| 8 | Set Screw | ¼" 8-32 R.H.M.S. | Brass | 1 | 5 |

*Fig. 5, First Prize Article*

Lay the three long pieces on their 2-inch faces and drill a ¼-inch hole three inches from both ends. Through these insert the 3½-inch carriage bolts. This is done as a precaution against future checking and subsequent cracking. Before the bolts are put in place smear them well with white lead; next, turn the pieces over on their 3-inch faces and drill a ⅝-inch hole six inches from one end. Two feet further down drill another ⅝-inch hole. On the other two pieces drill the ⅝-inch holes at both ends and space them as just described. For the sake of cleanness, I will designate the piece having the hole at one end as A, and the other two pieces as B and B¹. Eighteen inches from the upper ends of B and B¹ fasten the pipe flanges by means of 1½-inch wood screws. Six inches from the upper end of A fasten the screw eyes, one in the center of the 3-inch faces.

Six inches from one end of the piece




*Drawing, Second Prize Article*

Lay the piece, A, on its two-inch face and lay the pieces, B and B¹, one on each side of A so that the holes in the

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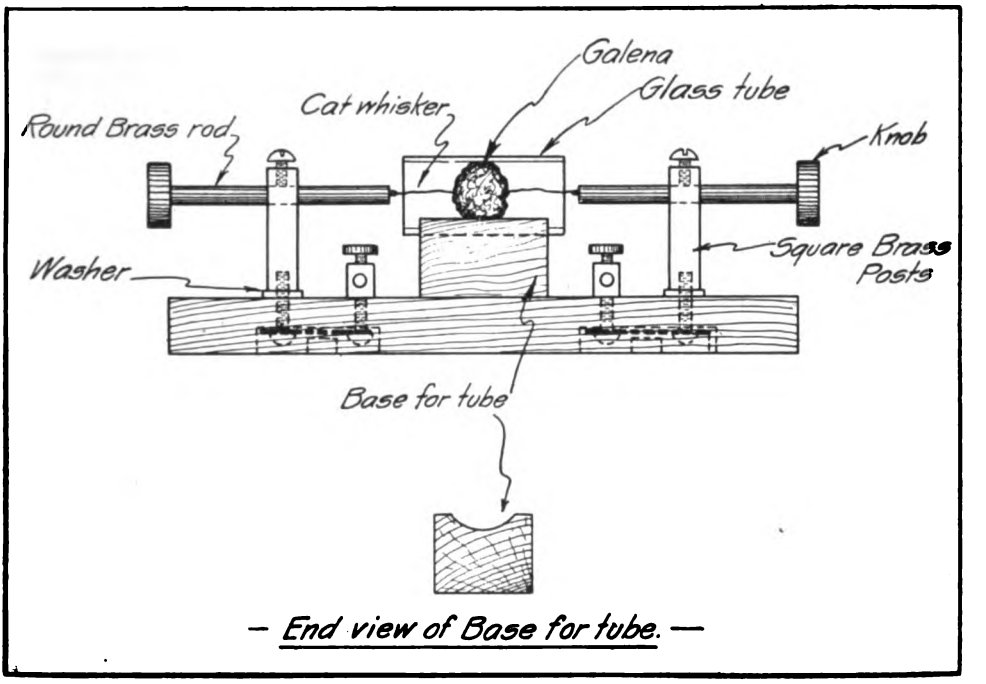


*Drawing, Third Prize Article*

lower end of A line up with those on the upper end of B and B¹. Pass the ⅝-inch by 7-inch bolts through the holes, using washers on both sides, but do not tighten them completely. Now, line up the holes in the lower ends of B and B¹ with those in the oak piece and pass through the ⅝-inch by 11 inch bolts, using washers on both sides. In both instances smear the bolts with white lead. Now lay the masts on two wooden saw horses or boxes whereby the assembly will be considerably facilitated. Then tighten the bolts of the middle splice. Next put on the lattice work. This is effected in the following manner: Place a piece of the 1-inch by 3-inch stock at an angle of forty-five degrees to the top edge of the oak piece and nail it fast with four 2½-inch nails driven in at an angle. Trim the ends flush with the sides of the mast. Then place another piece against the one just nailed down and again, nail down another piece. This latter piece is simply used as a spacer to get even spacing between the lattices. Next turn the mast over and nail the lattice work in the same manner, but in the opposite direction so that the front view of the mast presents a criss-crossed appearance, as shown in the drawing.

Put in place the other two flanges on the front and back of the mast at the same height as those previously mentioned and put in the four lengths of the pipe with the "tees" on their ends pointing up and down.

The wires which hold the mast vertically, acting as braces which prevent it from swaying, are next put into position. To do this, cut four pieces, twelve feet long and fasten a strain insulator on one end; the other end should be fastened to the screw eyes at the upper end of A. Fasten a wire to the other end of the strain insulator, pass it through the "tee" which has previously been bushed with a piece of rubber tubing. Fasten it to the turnbuckle which previously has been fastened to the screw eyes in the pieces placed in B and B¹. Do this with all four wires, fastening the front and back wires in the screw eyes placed in the lattices at the six-foot height. Adjust all the strain wires so that the mast will be in perfect alignment.

Dig a hole, 10 inches by 10 inches by 3 feet, 2 inches in depth, and set the oak

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piece in it to a depth of three feet. Fill the rest of the space with concrete. Having placed the pulley and rope in position and applied two good coats of paint to the entire structure, the mast is now

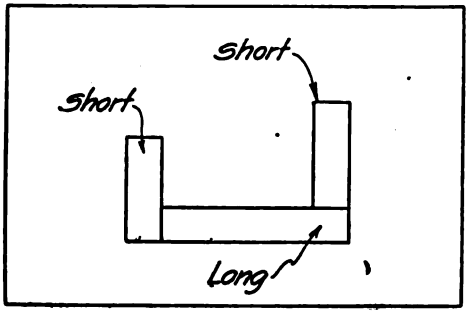


*Fig. 1, Fourth Prize Article*

placed in position. Fasten the lower end of the mast quite tight into the oak piece with one bolt, while the mast is resting on the ground. Three persons braced against the lattice work, with the aid of poles about 14 feet in length, can raise the mast to a vertical position. Two persons hold the mast in a fixed position, while the third changes his pole to a lower position. A fourth person now slips in the second bolt when the mast is in position.

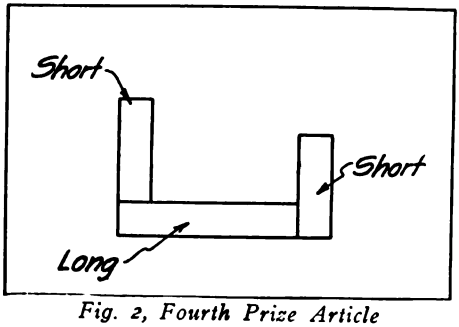


*Fig. 2, Fourth Prize Article*

The experimenter will find a mast of this type serviceable and strong in every respect. The one I constructed supports an aerial of three No. 12 copper wires on 5-foot spreaders with 3-inch ball insulators, the span being 70 feet in length.

RUDOLF SKRIWANEK, *New Jersey.*

## THIRD PRIZE, THREE DOLLARS

### A "Catwhisker" Detector of Unique Design

Like many other experimenters, I constructed several types of detectors before I found one wholly suitable for my station. After considerable experimenting I developed the design shown in the accompanying drawing, from which it will be observed that a crystal of galena is inserted in a glass tube, which is supported by a hard rubber base. Two round brass rods are mounted on the vertical brass binding posts and are fitted each with a small "catwhisker," preferably a fine piece of steel wire, which makes contact with either side of the crystal.

There are several methods by which this detector may be adjusted for sen-

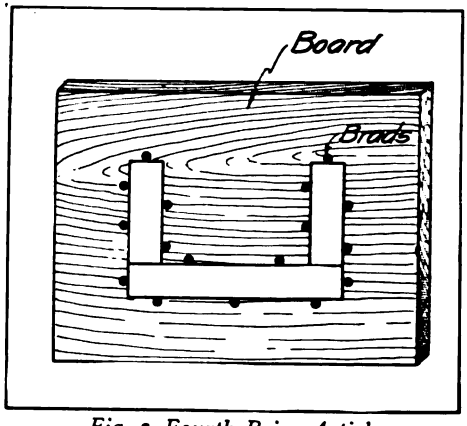


*Fig. 3, Fourth Prize Article*

sibility; first, the standards may be moved from side to side; second, the rods, to which the "catwhiskers" are soldered, may be moved in and out; third, the glass tube holding the mineral may be revolved.

If the mineral is too small to fit in the tube, wrap tinfoil around the edge until it just fits.

Owing to the lightness of the contact necessary with this type of crystal, I find it easier to locate a sensitive point with this type of construction than with any other design described. I trust the results obtained by others will bear out my statements.

DANIEL O'CONNELL, *New York.*

## FOURTH PRIZE, SUBSCRIPTION TO THE WIRELESS AGE

### An Efficient ½ k. w. 60 Cycle High Potential Transformer

The transformer of the type about to be described is one that has been thoroughly tried and tested and found to possess a high degree of efficiency.

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The dimensions and assembly of the coil will first be given. The strips of metal are preferably made of silicon steel, although ordinary soft iron may be used with a loss in efficiency. For the complete core 230 pieces of sheet iron, 4¾ inches by 2 inches, and 230 pieces, 7¾ inches by 2 inches, are required. After the sheets have been cut to the proper size, remove all rough

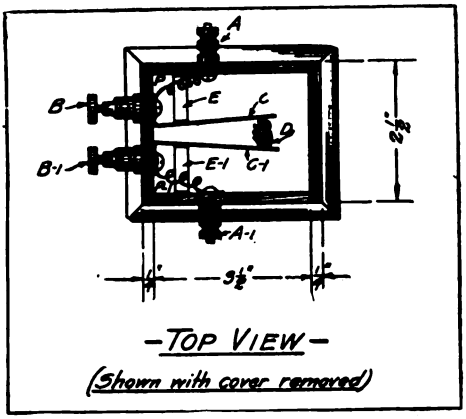


*Fig. 1, Honorary Mention Article, Carl W. Crouse*

edges with a file, then place the strips on a flat piece of metal and beat them out perfectly flat with a light rawhide mallet. Place the long pieces in one pile and the short pieces in another. Start the assembly by placing a long strip in position, followed by two short ones, according to Fig. 1. In the second layer, reverse the positions of both long and short strips, according to Fig. 2. The third layer is placed in position like the first, while the fourth is laid out similar to the second layer.

The assembly will be considerably facilitated if long brads are driven into a smooth board, as shown in Fig. 3; thus the strips of iron can be more readily placed in position, using the nails as guides.

After the short pieces of iron have all been used and one of the longer legs of the core is complete, bind one of the short legs tightly with two layers of friction tape. This leg is for the primary winding. The secondary leg must be insulated with two layers of 3-64-inch sheet mica, 2½ inches in width, which is secured in position by a layer of friction tape.

The secondary coil, which consists of three pounds of No. 32 enameled wire, is wound on a circular form of oiled paper, 3-16 of an inch in thickness, and of proper diameter to fit the core. Two layers of oiled paper are used between the layers of the winding and also over the last layer. The winding should extend to within ⅜ of an inch of the edge of the oiled paper. The final connections from the secondary winding are made from thin copper ribbon which is soldered to the enameled wire, making connecting leads that are not easily broken. When the secondary coil is completed, give it a coat of best quality shellac and dry thoroughly.

The primary winding is made on a form similar to the secondary with two layers of oiled paper between the layers of the winding. It consists of 350 turns of No. 14 double cotton covered wire wound in layers. When the coil is completed, bind it tightly with a layer of tape followed by a coat of shellac, after which it is allowed to dry. When both coils are thoroughly dry, put them in their respective positions on the core, after which the remaining strips of iron are placed in position one

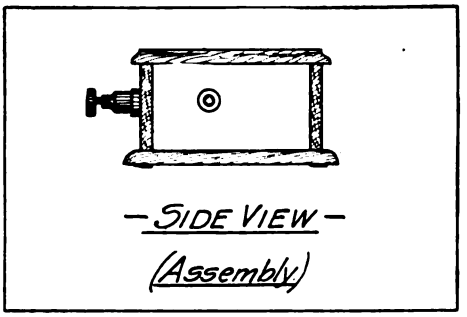


*Fig. 2, Honorary Mention Article, Carl W. Crouse*

by one, a mallet being used to drive them in place if necessary.

The finished transformer should be mounted in a small neat box and supported in the latter by blocks fastened underneath the core. The primary wires should be brought to binding posts on one end of the box, while the secondary leads may be brought to binding posts mounted on electrose, hard rubber or other suitable insulated bushings.

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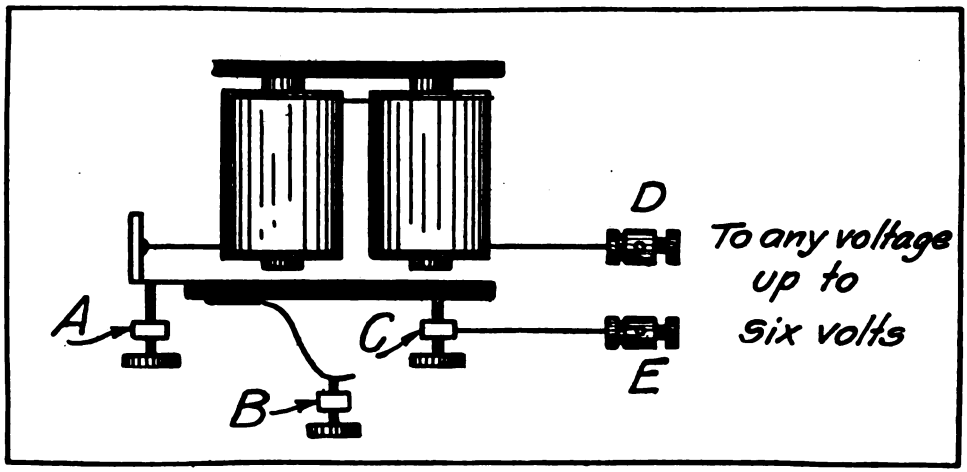


*Drawing, Honorary Mention Article, John G. Speicher*

When complete the transformer draws about 5 amps. on a 110-volt, 60-cycle source of current.

If constructed in accordance with the foregoing instructions, the transformer described will well repay the time and money expended upon it and should be a source of satisfaction to its maker.

PAUL J. HOFFMAN, *New York.*

## HONORARY MENTION

I constructed a receiving detector along the lines indicated in the accompanying drawing which I have used at my station for an indefinite period without burning out. In fact, it has remained in adjustment continuously and has required no attention on my part.

In the drawing D is a carborundum crystal which is held between two pieces of spring brass, C. These should be about ⅜ of an inch in width and 2¼ inches in length. They are bent and fastened to the binding posts, B and B-1, as shown. These binding posts are for connection to the head telephones and are connected by the wires, P and P-1, to the binding posts, A and A-1, respectively. The latter are connected to the leads from the receiving tuner. The box I constructed (Fig. 2) is 3½ inches in length, 2½ inches in width, and 1½ inches in height.

After the foregoing parts are completed and the base has been put on, the crystal is placed in the holder and adjusted for sensibility. When a place is found where the signals come in very loud (as they should if the crystal is a sensitive one) the box is filled with sealing wax and the cover put in place.

My experiments reveal that carborundum crystals of a pinkish color are the most sensitive and I find that in the majority of cases local battery current is not required. With a detector of this type, a 2,000-ohm Brandes head set, a triple slide tuner and a 40-foot aerial, I am enabled to receive signals from the Arlington station every night.

CARL W. CROUSE, *Illinois.*

## HONORARY MENTION

I found by experiment that to produce a high tone from an ordinary buzzer, the armature must vibrate in a small arc. Also the vibrator should be adjusted as rigidly as possible. To effect this I bent back the usual small spring, between the armature and the set screw, and set the contact maker, C, next to the soft iron armature. I also attached a second set screw at A and a third one at B. By careful adjustment of all screws an extremely high spark note is produced, which will be found very satisfactory for the adjustment of crystals or other requirements at a radio station.

My experiments reveal that the following method of adjustment is practicable; the set screw, A, should be turned

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about three turns and then the set screw, B, adjusted one turn or two, until the satisfactory tone is produced. The set screw, C, should be so adjusted as to allow twice the width of the armature between the electro magnet and the point of the set screw, C.

JOHN G. SPEICHER, *Illinois.*

## HONORARY MENTION

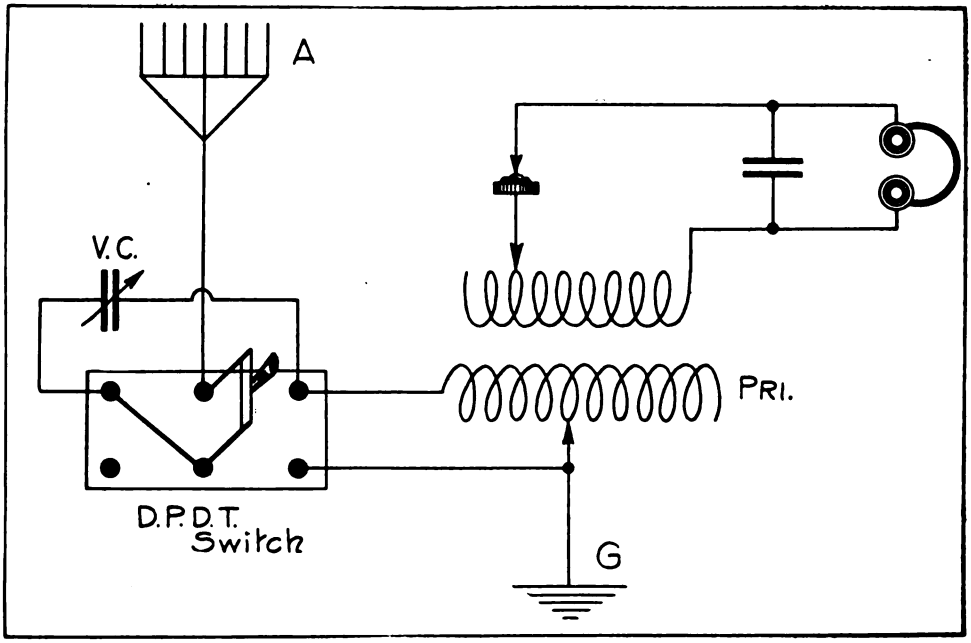
The accompanying diagram indicates how a variable condenser may be connected either in series with the antenna system or in shunt to the primary winding of the receiving transformer by means of a single switch. When the switch is in the position indicated in the drawing, the condenser is connected in series. When it is turned to the left the upper two contacts are connected together and the lower two on the left likewise. This places the condenser in shunt to the primary winding. The two brass parts of the switch must be insulated from each other in order to effect the purpose as described.

I have noticed that in practically all high priced receiving sets, especially in the Marconi apparatus, there is a switch of this type used in some portion of the circuit and, therefore, I thought it would be of value to the amateur reader.

FOSTER E. STURTEVANT, *New Hampshire.*

## HONORARY MENTION

At this season of the year the amateur who spends considerable time out of doors is interested in the design of a portable receiving set. I suggest the design shown in Figs. 1 and 2. The transmitting set contains a spark coil, a spark gap, a helix key, condenser, etc., while the receiving set consists of an inductively-coupled receiving tuner, fixed and variable condensers, galena and silicon detectors and head telephones, all securely mounted in place.




*Drawing, Honorary Mention Article, Foster E. Sturtevant*

The case is made of oak and opens like a desk, the lower portion of the case holding the batteries for the sending set and also containing a drawer in which the head telephones and other necessary accessories may be carried.

This set is very convenient for any amateur wishing to take a camping trip, with the additional assurance that, when the apparatus is not in use, it may be locked up to prevent meddling. The case

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is also dustproof and corrosion or rust troubles are eliminated.

D. B. ALCORN, *New Jersey.*

## LONG DISTANCE COMMUNICATION

In reference to the articles by R. H. E. Mathews, and N. B. West, in the February and March issues respectively of THE WIRELESS AGE, I wish to report that I also have successfully worked with 9-KU and, as Mr. West states, 9-KU was tuned by the radio inspector to a sharp 200-meter wave. At the time I communicated with him I was using a cheap pair of 2,000-ohm receivers and, it was the early part of the season at a time when receiving conditions were not at their best. I have heard this station a number of times since, while using a single vacuum valve bulb, and recently with a galena crystal.

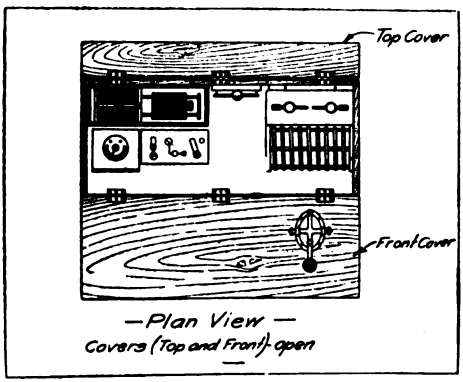


*Fig. 1, Honorary Mention Article, D. B. Alcorn*

I have also communicated with a 200-meter station at Lawrence, Kans., without any difficulty whatsoever. The latter station was very sharply tuned and has been heard at my station, between 4 and 5 p. m., central standard time. These signals were received on a single vacuum valve bulb. While the distance covered is more than 500 miles, these results are not at all uncommon in the Middle West, and the fact that I have also communicated with stations in or near New York City, operating on very short waves and at a time when atmospheric electricity made the reception of signals very difficult, would indicate that such results need not be uncommon in the East as well as in the West.

I believe that if the apparatus is properly tuned, the spark carefully adjusted and the correct value of condenser capacity employed, and particular care is taken to cut down all resistance joints and leakage of the high potential energy, it is not at all difficult to communicate with an amateur 200-meter set at a distance of from 60 to 100 miles during the daytime, even in summer, regardless of the locality.

MRS. CHARLES CANDLER, *Ohio.*

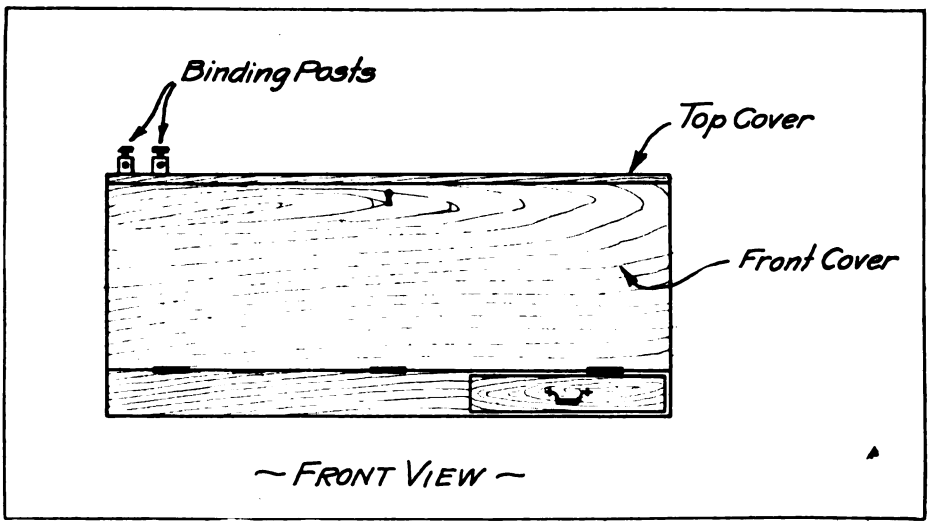


*Fig. 2, Honorary Mention Article, D. B. Alcorn*

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## VESSELS RECENTLY EQUIPPED WITH MARCONI APPARATUS

| Names | Owners | Call Letters |
|---|---|---|
| Curacao | Pacific Coast Steamship Co. | WGK |
| Ravalli | Pacific Coast Steamship Co. | WGI |
| Cubadist | Cuba Distilling Co. | KNV |
| Mielero | Cuba Distilling Co. | KNT |
| Sucrosa | Cuba Distilling Co. | KNS |
| D. N. Luckenbach | Luckenbach Steamship Co. | KGW |
| Calgary | Standard Oil Co. of New Jersey | VEV |
| Clan Ferguson | Clan Line | YOQ |
| Petoskey | Chicago & South Haven Steamship Co. | WDH |
| Conneaut | Wyandotte Transportation Co. | WCU |
| S. Y. Galatea | E. L. Ford | WGF |
| Suruga | Barber & Co., Inc. | KGD |
| Jalisco | Mexican Navigation Co. | XXA (Temporary) |
| Coahuila | Mexican Navigation Co. | KEW |
| Tegucigalpa | Vaccaro Brothers & Co. | VB |
| Westwego | Union Petroleum Steamship Co. | KGE |
| G. R. Crowe | G. R. Crowe S. S. Co., Ltd. | VET |
| Dara | Bombay-Persian Steam Navigation Co. | TZK |
| Matinicock | Standard Oil Co. of New Jersey | KID |
| Standard Arrow | Standard Transportation Co. | KSV |
| Royal Arrow | Standard Transportation Co. | KSW |
| Acme | Standard Transportation Co. | KIJ |
| Astral | Standard Transportation Co. | KIQ |

## THE SHARE MARKET

NEW YORK, April 11.

Quoted today at 2, the shares of the Canadian Marconi company have registered a notable advance. In spite of the war conditions in the Dominion, the company is doing a profitable business and the rise in the price of the stock did not surprise those who have kept informed concerning the business of the corporation. As the par value is five dollars, an increase of one-quarter corresponds to a rise of five points on a stock with a par of $100.

The publication of the annual report of the American Marconi Company, although very favorably commented on in financial circles, made absolutely no difference in the price of the shares, on account of the dullness of the market. In London the closely-held shares of the English company moved up from one-half to one point.

Bid and asked quotations today: American, 3⅝-3⅞; Canadian, 1⅞-2¼; English, common, 10-12; English, preferred, 9-11½.

## CARRANZA ORDERS EQUIPMENTS

Y. G. Jurado, representing the Carranza Government of Mexico in San Francisco has closed a contract with the Marconi Wireless Telegraph Company of America, calling for four 5 k.w., 500-cycle, quenched gap wireless sets. These are to be installed in plants that the Mexican Government proposes erecting at various points along the Mexican Coast.

## MEETING POSTPONED

The annual meeting of the Marconi Wireless Telegraph Company of America, which was called for April 17, at Nos. 243 and 245 Washington street, Jersey City, N. J., was postponed till twelve o'clock, noon, May 17, on account of the absence of a quorum. Of 1,880,414 shares outstanding, 343,456 were represented.

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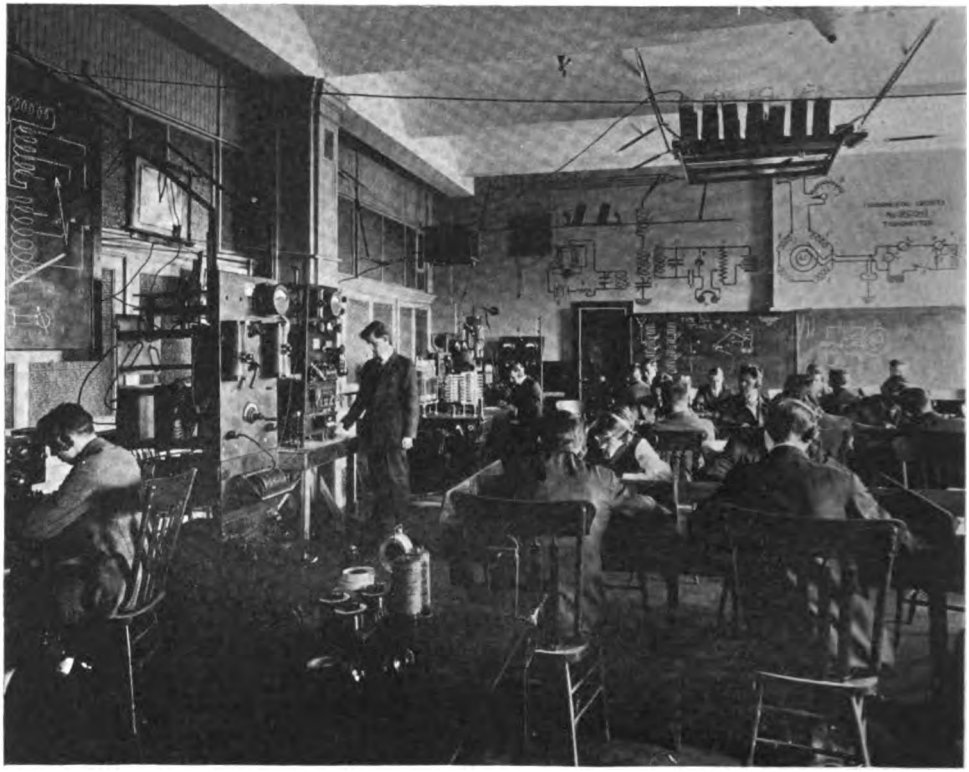
# The Marconi School of Instruction

## Educating Prospective Guardians of Ships and Lives



*A class of young men in the School of Instruction, studying to become proficient in wireless*

IN a large, high hall filled with the regulation operators' tables, sat a group of serious looking boys with head telephones clamped over their ears. On the walls were sweeping black diagrams of wireless apparatus and the upper works of a ship with an aerial swinging between the masts. Around the walls stood alternators, heavy motor-generators, detectors that have caught far-away Nauen, tuners, wave-meters—in fact, all the apparatus necessary for the complete equipment of wireless stations. In the midst of these instruments sat students of the radio art copying rapidly on yellow pads the messages that came from the Wheatstone automatic transmitter. This was the panoramic impression received by a visitor at the Marconi School of Instruction in New York City.

The school, which is at No. 25 Elm street, was established in 1912, under the supervision of its present instructing engineer, E. E. Bucher. The qualifications for entrance are not severe. The application of any young man between the ages of eighteen and twenty-five, with a grammar school education



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and two good references, will be considered. Neat appearance is essential, and the education of the prospective wireless operator should include a sound knowledge of arithmetic and geography, together with the ability to write with reasonable speed and legibility. While familiarity with electricity and enough practice to receive in the continental code at the rate of ten words a minute are highly desirable, it is not an absolute requirement, for the school provides unexcelled facilities for the attainment of this special skill.

Unlike a wire telegraph operator, the wireless man must have a thorough knowledge of the construction and operation of his apparatus. Before an operator is allowed to take charge of a Marconi station, he is required to obtain a first grade commercial license issued by the United States Government, and to do so must be able to connect up a complete wireless equipment. He will be asked to draw a circuit diagram of the set, make temporary repairs, locate faults, adjust the wavelength and, in general, grasp the theory and practice of the operation of every part of the set. As no two students absorb all parts of the course with equal facility, the instruction has developed into a system of individual coaching. Supplementing a great deal of practical work and a series of lectures, several text books have been adopted. These consist of "Radio Communication Laws of the United States," "Handbook of Regulations, U. S. Naval Radio Service, 1913," and the "Naval Manual of Wireless Telegraphy for 1913," by Commander Robinson. On shipboard only the continental code is used, although shore operators who handle land line messages must be familiar with Morse as well.

In the class room every desk is fitted with a head telephone and a buzzer. The latter accurately imitates the sound of a standard wireless transmitter. The operators' tables are so connected that Harry Chadwick, telegraphic instructor, is able to send to all the class at once, to special groups or to individuals in the class. A ship's call letter is assigned to each of the students. By the use of the Wheatstone automatic transmitter any rate of sending speed can be obtained so that the student may practice receiving anywhere from ten words a minute up to the human limit.

The mechanical equipment of the school is unusually complete, consisting of a ½ k.w., 500-cycle set, another ½ k.w. set of 120 cycles, two 2 k.w. sets of 500 and 240 cycles respectively and two 1 k.w. sets of 60 and 500 cycles. There is a storage battery emergency outfit, all types of Marconi receiving sets, a full equipment of experimental apparatus, including a Fleming cymometer for determining wave-lengths and high frequency measurements, and several kinds of wave-meters and decremeters.

The average student completes the course in three and a half months. Then he is assigned to a ship, where he receives the rank of a junior officer and a salary ranging from $25 to $60 a month, with meals and quarters while on shipboard. A commission of twenty-five per cent. of the message tolls which accrue on the vessel are divided between the junior and senior operators. There are a number of money-making sidelines that the operator can carry on in addition, such as handling the sales of the Ocean Wireless News—a daily newspaper published on passenger ships at sea. Later on, graduates of the school who have shown special ability may be transferred to land stations or enter the engineering or construction departments of the company.

Wireless operators receive almost unlimited shore leave in foreign lands, and there is no port from Punta Arenas to Archangel where wireless equipped steamships do not touch. No longer is it necessary for the boy who craves the varied scenes and excitement of a seafaring life to bind himself to a long, hard apprenticeship before the mast; the cabin boy of fiction has given place to the alert wireless operator—the guardian of the vessel and a trusted assistant to the captain himself.

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# Hammond's Wireless-Dynamo Torpedo

*John Hays Hammond*

## Details of the Invention Brought Out in Congressional Hearing on United States Fortifications

JULES VERNE, with all his imagination, again has been outdone by modern inventive genius, says a Washington correspondent. Sandwiched in among the technical details about coast defenses in the recent hearings on the fortifications, is the story of the Hammond torpedo, scientifically called the wireless-dynamic torpedo.

There has been a good deal of discussion about this invention of the young son of the mining engineer, John Hays Hammond, but until this time it has not been disclosed in such detail. In question and answer form the hearings tell a remarkable story of its performances. As already reported, the invention has so conclusively demonstrated its efficiency as a destructive agency that the United States Government is preparing to buy the patent and to proceed with installations for coast defense. The fortifications bill carries an initial appropriation of $1,167,000. The inventor wants his own government to have the benefit of his device on terms that are pronounced most reasonable. England, it is said, is willing to pay $10,000,000 instantly for it.

There is one condition attached to the acquirement of the patent rights by this government. The torpedo must demonstrate its value before a joint army and navy board.

The virtue of the wireless-dynamic torpedo is thus explained by Mr. Hammond:

"You can take a charge of explosives or a projectile and deliver it at the target under constant control from the shore."

The torpedo, as described by Mr. Hammond, is at present of two types—one to be used above water, traveling at fifty miles an hour, and the other a submerged type, except for a short wireless mast virtually immune from gun fire, with a speed of twenty-eight miles an hour. The surface type is a new sort of craft, called by naval experts the sea sled. They can be made of any size desirable for the purpose in view and travel so fast as to be safe from destructive gunshot.

The experiments at Gloucester have been made with a thirty-ton boat. The inventions do not cover any special type of boat, but the patents relate wholly to control and to the method of firing torpedoes from these carriers. The boat can be controlled just as easily for most purposes from an aeroplane or warship as from a shore station.

Here is a summary of some of the features of the invention, according to description:

It can be steered by wireless in any direction.

Its engines (two 500-horsepower gasoline motors) can be started, stopped and controlled at various speeds by wireless.



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It can carry a ton of high explosive.

It is more accurate, in the opinion of army experts, than the fire of big guns.

It can be operated against an enemy by a single man, who remains ashore, or on a warship, or in an aeroplane, and whose sole instruments are a telescope and an electric key.

It cannot be interfered with by adverse wireless waves, because it is controlled by a system of selective transmission.

If the wave-length controlling it is discovered by an enemy, that wave-length can be changed while the torpedo is in sight.

If an enemy attempts to interfere with it by wireless, it possesses the faculty of pointing immediately in the direction of that enemy and making directly for him.

It can be operated at night as well as day, subject to accurate control by an arrangement of tiny lights, so shielded as to be visible only to the operator.

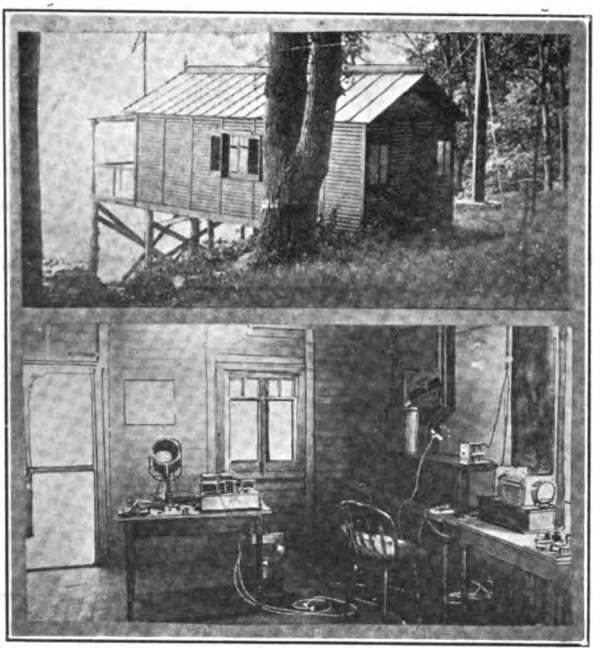
It carries a searchlight of its own, which may be turned on and off by wireless.

The surface type will cost about $47,500 each.

The submarine type will cost about $9,000 each.

The surface type has a cruising radius of 200 miles, at fifty miles an hour.

It can be guided 200 miles to sea by an aeroplane and launched against an enemy at the end of the run.



*Two views of Hammond's wireless plant at Gloucester, Mass.*

The surface type has a capacity of double attack. It carries a torpedo which, when the destroyer is in striking distance, can be launched by wireless. If the torpedo strikes the destroyer can be turned around by wireless and sent home. If the torpedo misses, the destroyer, which carries an additional half-ton of explosive, can be sent on to retrieve the error, in which case, of course, it is itself destroyed upon impact.

The beginning of young Hammond's work and the operations of the boat are thus informally narrated by General Erasmus M. Weaver, chief of coast fortifications:

"I went to the operating house on the shore of the bay, where there was a man seated at what appeared to be a telegraph instrument, and out on the water a boat was moving. At that time I did not connect the boat with the building I was in. After a few minutes' conversation Mr. Hammond said: 'If you will give any instruction to that boat it will execute your orders.' Then I realied that the controlling apparatus was on shore and that the apparatus directed was on the boat that I had noted.

"I asked that the boat be made to go to the right. The craft was a very rapidly moving motor boat. The operator touched a button and the boat immediately went off to the right. Then I said: 'Now have it go to the left,' and he pressed a button twice and off it went to the left. That was becoming rather in-

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teresting. Then I asked him to have it go around a buoy about 5,000 yards out, and by operating a button it went up to a buoy and then around it one way.

"I asked him to have it go the other way, and it went around in the opposite direction. A schooner was coming in, and I said I would like to have the boat pass in front of the schooner. It made for the schooner and passed in front of it. Then I had it sent around the other way, and I said: 'Bring it in here; I want to see what it is.'

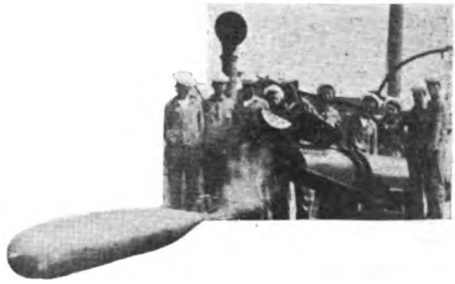
"I went aboard, saw the mechanism and had it explained to me. I was impressed with it. While, of course, the secret components were not evident, still the main operative features were. I was much impressed with its simplicity; that is, it was much more simple that I had any idea it could be, and based on that exhibition alone I made up my mind that Mr. Hammond had accomplished a thing that was really practicable.

"I have no doubt that it can be more accurately directed than we can direct the fire of guns. The possible scope is beyond anything we have ever had in mind before, and it is difficult to see to what limits it might not be extended."

As to the method of control, Mr. Hammond explained that a wireless station of special design is located out of range of enemy fire. This is connected by land wire lines with a series of concrete turrets stretched along the coast and each occupied by a single observer. Each observer is able to operate through the wire connection a wireless transmitter at the wireless plant. Each operator controls enough energy to send out one torpedo.

"In order to have the system flexible," added Mr. Hammond, "the torpedo is started from its base, goes out into the radius of observation of controller No. 1, is passed along to controller No. 2, and so on to whatever controller in whose radius of vision the enemy is located. Then this observer takes up the direct control of the torpedo and steers it toward the enemy."

Besides this feature of having one or more observers control in turn the movements of a torpedo as the circumstances may dictate, Mr. Hammond has provided against the enemy's being able to assume control of the boat. When he began work he found there were two things to guard against. One was the question of interference by wireless energy from the enemy; the second was the attempt to destroy the torpedoes or boats by gunfire from enemy ships. The second question, in the judgment of Mr. Hammond, is settled by the speed. The chances of hitting a small object such as this boat, traveling fifty miles an hour, are regarded as negligible.



*The wireless controlled torpedo hits a bamboo pole at three miles*

The first problem stated, that of preventing wireless interference, has been solved, according to Mr. Hammond, by an arrangement of selective transmission.

"I have evolved a system," says Mr. Hammond, "which when there is interference present in the way of wireless energy coming from an enemy, will cause the torpedo to turn around and face that source of energy. The torpedo will move toward it."

Lieutenant Styles M. Decker of the Coast Artillery, with Captain J. B. Beahr, was detailed for two years to watch Mr. Hammond's experiments. Lieutenant Decker tells the following story of the destroyer's accuracy:

"While we were circling around the harbor we pitched over a cane pole, an ordinary old-style fishing pole, which had a light weight on the bottom and a disk of ordinary burlap about twelve inches in diameter around the upper part, which acted as a target. I should estimate we were within a distance of something like three miles from the operator on shore.

"He took charge of the boat and brought us to within about one and a

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half miles of shore, and then turned us around and started us for the target. In the meantime the tide was taking the target out at a great rate, and it was getting farther and farther away.

"We ran right square into the target the first trial, turned around and came back 200 or 300 yards. We were then steered for the target and struck again, and kept repeating this form of target practice, until it became quite monotonous, because the boat never missed at all." As to the question of keeping the invention for the exclusive use of the United States, Mr. Hammond said:

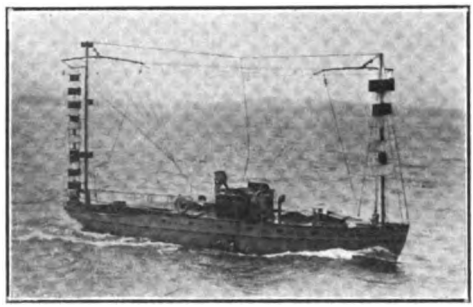
"In my own laboratory, where this thing has been developed, I can say there is only one man besides myself who understands the complete mechanism. I have differentiated the work so as to place one man on one line and another on another line, and none of these men knows the combination of the thing. Only one man under me knows the combination of all these things. The same method could be observed in the way the army handles it.

The terms upon which Mr. Hammond offers to sell his invention exclusively to the United States are these, proposed to the War Department in a letter:

He will assign all patents to the United States Government for the sum of $530,000, plus ten per cent. of the cost of installing each radio station, whether ashore or aboat, plus $10,000 royalty for each destroyer built. This is based on an order of not less than three units, a unit consisting of one station and ten destroyers. If the government builds only two units, the lump sum is to be $630,000. If it builds only one unit, the lump sum is to be $730,000.

In addition, Mr. Hammond will give his time and his services to the government in installing and developing the system, so long as the War Department wants him. As an alternative proposition, in the case the government does not want the exclusive rights, Mr. Hammond will sell the manufacturing rights for the United States alone for $350,000.

The destroyers themselves may be built even more rapidly than the control stations, which will require nine or ten months in construction. The type of boat favored by Mr. Hammond for the surface destroyer is the sea sled, which has demonstrated its tremendously high speed in motorboat racing.



*The Hammond boat at sea*

## INSURANCE FOR MARCONI EMPLOYEES

*(Continued from page 535)*

meantime, however, under the agreement made with The Travelers Insurance Company this insurance is effective as of April 1, 1916 upon all in the active service of the company on that date, whose period of service entitles them to receive such insurance.

In consummating this arrangement, it gives us pleasure to acknowledge the high order of intelligent and zealous service which has characterized the work of our employees in the past and we have every confidence that it will be continued in the future.

With every good wish for the greater success and happiness of all,

Very truly yours,

E. J. NALLY,

Vice-President and General Manager.

The foregoing was received enthusiastically by those in the Marconi service. This fact was evidenced by a number of letters sent to the company's offices in New York, expressing appreciation of the boon.

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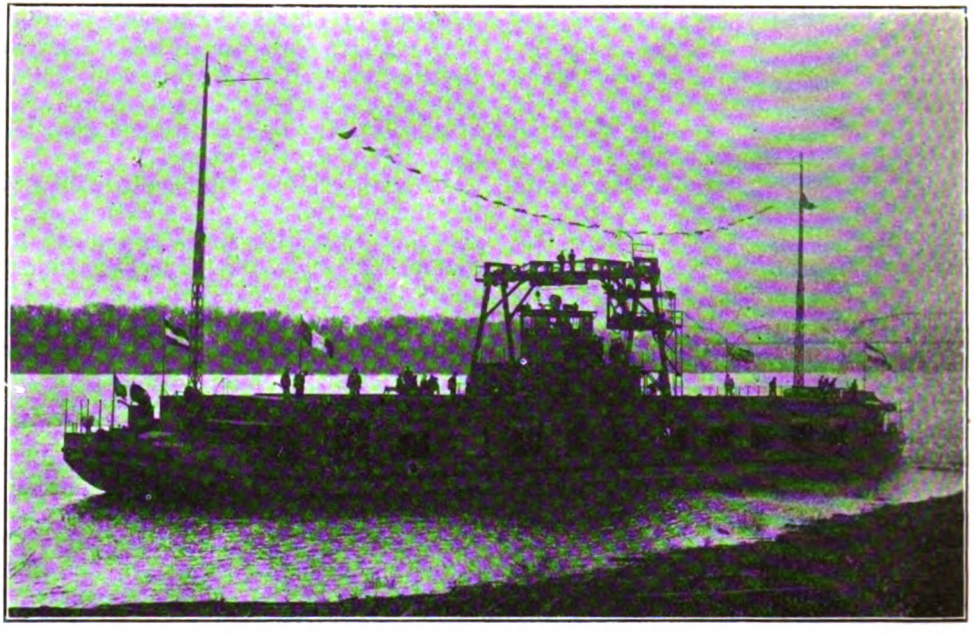
# The First of the Mississippi Barges Equipped



*Barge No. 1 leaving Jeffersonville, Ind., on her trial trip*

BARGE No. 1, owned by the Inland Navigation Company, one of the thirty-six power vessels which the Marconi Wireless Telegraph Company of America contracted to equip with radio apparatus, is the first of the craft to be fitted out. Following her trial trip, which took place recently on the Ohio River, near Jeffersonville, Ind., she proceeded to the Mississippi River and when near St. Louis, her operator established communication with a vessel in the Gulf of Mexico.

No. 1 is equipped with a 2 k.w. 500 cycle panel type Marconi quenched gap set. Her masts, which are self-supporting, stand eighty-five feet from the load line and are built in telescope form. The top mast, which is made of wood, can be let down into the lower steel section, permitting the barge to pass under bridges. The aerial is of the T type and when the crane is in operation, either aft or forward, the vertical part of the aerial can be thrown over the crane and again connected with the wireless apparatus, permitting the radio equipment to be in use, regardless of the position the hoisting machine may be in. Located on the starboard side, directly under the crane, the wireless cabin is the largest compartment on the barge, not excepting the captain's.

The vessels which the Marconi Company contracted to equip for the Inland Navigation Company are designed to travel on regular schedules on the Mississippi River between Minneapolis and New Orleans, with stops at all impor tant points on the river and its tributaries. There are many attractive features surrounding the post of wireless operator on these barges, for they have the conveniences of an ocean liner with the exception of a gymnasium.



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# Queries Answered

**Answers will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all letters and only one side of the paper written on; where diagrams are necessary they must be on a separate sheet and drawn with India ink. Not more than five questions of an individual can be answered. To receive attention these rules must be rigidly observed.**

**Positively no Questions Answered by Mail.**

H. P. G., Portsmouth, Va., inquires:

Ques.—(1) What should be the specific gravity of the electrolyte for the electrolytic detector?

Ans.—(1) It is the general practice to employ a 20% solution of nitric acid. Fair results will be obtained with a similar solution of sulphuric acid. A supersaturated solution of caustic potash has often been successfully employed.

Ques.—(2) Should the positive pole of the battery be connected to the fine point of this detector or to the larger electrode?

Ans.—(2) In the Fessenden type of electrolytic the fine wire point is connected to the positive pole of the battery.

Ques.—(3) What are the relative merits of this detector? What additional apparatus is necessary to make it function?

Ans.—(3) It is sensitive and will give good results when properly handled. The potentiometer should have resistance from 300 to 400 ohms and the battery connected to it a potential of about 4 volts. The fine wire electrode should be about 1/10,000ths of an inch in diameter, adjusted to just make contact with the liquid. The detector is stable in operation, particularly when the fine wire electrode is sealed in glass, making it independent of vibration. Severe impulses of atmospheric electricity will burn off the fine platinum electrodes when it is not protected by the glass coating.

Ques.—(4) What is the correct value of resistance for the telephones employed in connection with the vacuum valve detector?

Ans.—(4) The telephones generally have resistance of from 2,000 to 3,000 ohms, although the matter is not so important with this type owing to the potential of the local battery. Very good results can be obtained with telephones of 75 ohms resistance. Keep in mind that it is not the resistance of telephones which determines their sensibility; it is the over-all construction that must be taken into consideration.

* * *

B. H. N., Fort Monroe, Va., inquires:

Ques.—(1) I have a tube for the primary winding of an inductively-coupled receiving tuner which is 18 inches in length and 8 inches in diameter. The secondary tube is 18 inches in length and 7 inches in diameter. The tuner is to be used with an aerial of 750 meters wave-length, but the circuits are to be raised to a wave-length of 12,000 meters. The secondary winding will be shunted by a condenser of .005 microfarad capacity. What dimensions are required for the loading coil?

Ans.—(1) Wind the primary tube with No. 24 S. S. C. wire and tap it at intervals of ½ inch for variation of the inductance value. The secondary winding is preferably covered with No. 32 S. S. C. wire and will respond to the wave-length of 12,000 meters with small values of capacity at the .005 microfarad condenser. The wave-length of the primary winding may be raised by connecting a variable condenser of small capacity in shunt to it. The secondary winding should be tapped at intervals of 2 inches.

* * *

B. J. B., Philadelphia, Pa., inquires:

Ques.—(1) What is the wave-length of my aerial which is 44 feet in length, 35 feet in height, with a 10-foot lead-in? It is of the inverted L type.

Ans.—(1) Assuming it to be of four wires with the usual spacing, the fundamental wave-length is approximately 130 meters.

Ques.—(2) Give diagram or description of a 110-volt buzzer to be used for transmitting experiments.

Ans.—(2) A buzzer of special construction is required to be operated at a pressure of 110 volts D. C. The resistance of the windings should be at least 110 ohms. There are several methods for exciting an antenna by a buzzer. For example: A condenser of fairly large capacity, say .05 microfarad, may be connected in series with the antenna and the terminals of the condenser connected across the contacts of the vibrator on the buzzer. This has been found to be an efficient method for ordinary working. Sometimes the condenser is eliminated and the antenna and earth connections connected directly across the contacts of the buzzer. Another method is to connect a coil of inductance in series with the antenna system, the coil in turn being connected to a bell buzzer and a battery; that is to say, the battery, bell buzzer and coil are connected in series. In this method, when the buzzer is in operation, a change of the


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lines of force takes place in the coil, causing the antenna system to be charged, whereupon it will discharge at its own frequency of vibration.

Ques.—(3) Where can I secure or purchase a tikker and what is the average price of one?

Ans.—(3) We are not aware that this type of detector is on sale. You might communicate with the Federal Telegraph Company, at San Francisco, and ascertain if one can be purchased. The slipping contact type of tikker is now generally used. It merely consists of a small wheel with a slight groove cut in it rotated at a speed of approximately 1,500 revolutions per minute. A piece of elastic wire is placed in light contact with the groove in the wheel, the wheel being connected to one side of the receiving detector circuit and the spring contact to the other side. By careful adjustment of the spring a hissing sound of a medium pitch is produced in the head telephone.

Ques.—(4) Will a continuous wave receiving detector respond to damp waves?

Ans.—(4) A vacuum valve receiving set like that described on page 82 of the book "How to Conduct a Radio Club" will respond to either damped or undamped oscillations. The Poulsen tikker or the slipping contact detector will also respond to either damped or undamped oscillations, but the tone from signals of spark stations is very poor. Fair notes are obtained from 500-cycle spark transmitters.

With circuits employing the tikker type of detector it is customary to provide a secondary winding of low damping which is generally constructed of Litzendraht wire.

* * *

C. G., Louisville, Ky., inquires:

Ques.—(1) Can a vacuum valve detector be employed to amplify the signals received on a tikker? That is to say, can an auto transformer be connected in place of the head telephones ordinarily used in shunt to the fixed condenser of the tikker set? And can the connections be led from the transformer to the grid of the vacuum valve?

Ans.—(1) The apparatus will give good results connected in this manner. An auto transformer is not required. The grid of the vacuum valve detector may be connected to one terminal of the fixed condenser and the filament to the opposite terminal of the fixed condenser. A condenser of fairly high capacity should be connected in series with the grid of the vacuum valve.

Ques.—(2) Referring to the book "How to Conduct a Radio Club" should the coils, L-2, L-3, L-4 and L-7, in the diagram on page 82 have taps and if so, how many?

Ans.—(2) The coils, L-3 and L-7, may be tapped every three inches or so throughout their lengths. The coil, L-2, should be tapped every half inch. The coil, L-4, may be tapped every inch since the necessary fineness of adjustment is obtained at the variable condenser, C-2.

Ques.—(3) How many feet of wire are required to wind the coils mentioned in the second query?

Ans.—(3) The coils, L-3 and L-7, are identical. Each requires approximately 1,860 turns of wire or about 2,600 feet. The coil, L-3, has approximately 1,000 turns and requires about 1,400 feet of wire. The coil, L-2, has approximately 540 turns and requires about 760 feet of wire.

Ques.—(4) Where can I purchase cardboard tubes having diameters of 5 inches, 5½ inches and 6 inches?

Ans.—(4) Communicate with Ware & Co., Watt street, New York City.

* * *

W. R., Springfield, Mo., inquires:

Ques.—(1) Referring to page 82 of "How to Conduct a Radio Club," how many taps should be taken from the coils L-3 and L-4?

Ans.—(1) The coil, L-3, should be tapped about every third inch, while the coil, L-4, may be tapped inch by inch.

Ques.—(2) Does it make any difference which pole of the high potential battery is connected to the plate of the vacuum valve bulb?

Ans.—(2) The book states specifically that the positive pole of the high potential battery must be connected to the plate.

* * *

T. P. H., Dubuque, Ia., inquires:

Ques.—(1) Upon what theory is the comparative inefficiency of indoor antennæ based? Has any author taken up this subject to any extent? What have been the results with indoor aerials?

Ans.—(1) The matter can be explained by calling attention to the fact that the usual indoor aerial has not the dimensions of those erected in open space. A slight absorption of energy takes place when an electromagnetic wave is required to pass through an insulating substance, but is not so detrimental as many suppose. Many experiments have been made with indoor aerials and the results obtained by some compare favorably with those obtained from the usual outdoor aerial. We are tempted to believe that the effectiveness of the ordinary receiving aerial would be hindered but a very little by erecting a large wooden building about it.

Ques.—(2) You will observe from the enclosed diagram that an aerial is represented as 800 feet in length, 125 feet in height at the further end and 70 feet in height at the instrument end. What effect has the fact that the chimney is actually lower at its top than the height of the 70-foot end?

Ans.—(2) It will have no appreciable effect on the results obtained. It is possible that when receiving from a given transmitting station, a certain disposition of the aerial in respect to direction, angle of the flat top portion, etc., would give the best results; that is to say, it would receive the maximum of cutting by the electrostatic and electromagnetic lines of force in an advancing wave. However, practically any elevated conductor

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properly insulated, with the correct values of inductance capacity for resonance will give good results for receiving.

Ques.—(3) Would the aerial I have just described be suitable for long distance reception?

Ans.—(3) Yes.

Ques.—(4) Would I be able to receive from both Atlantic and Pacific coast stations, considering the fact that this aerial is supposed to be directive?

Ans.—(4) Probably the best results will be obtained from stations in a westerly direction, although you will, without doubt, be able to receive signals from either direction during the night hours of the favorable months of the year.

* * *

S. B., Binghamton, N. Y., inquires:

Ques.—(1) What is the natural wave-length of an aerial 75 feet in length, 35 feet in height, consisting of four wires?

Ans.—(1) With the usual spacing of 2 to 3 feet, the natural period of a natural wave-length is approximately 190 meters.

Ques.—(2) Can a condenser be connected across the primary or the secondary winding of an inductively-coupled receiving tuner to increase their capacity to a considerable value above normal, with results equal to those obtained from a loading coil?

Ans.—(2) Connected across the primary winding, the condenser usually has the effect of decreasing the strength of signals, although the wave-length may thus be raised. In this circuit it is preferable to use a loading coil. The actual value of capacity that may be employed in shunt to the secondary winding depends upon the type of detector used. With crystalline and vacuum valve detectors, the capacity in the secondary winding is usually limited to a value lying between .0005 microfarad to .001 microfarad. Rather than increase this value, it is preferred to insert a loading coil in series with the secondary winding.

Complete information for the building of a receiving set responsive to undamped oscillations appears in the book "How to Conduct a Radio Club," published by the Marconi Publishing Corporation.

* * *

J. G. S., Wisney, Neb., inquires:

Ques.—(1) What is the fundamental wave-length of a single aluminum wire 200 feet in length, 40 feet in height at the free end and 30 feet in height at the other end.

Ans.—(1) The fundamental wave-length of this aerial is approximately 310 meters.

Ques.—(2) Is it necessary that an aerial point in the direction of a sending station?

Ans.—(2) An aerial of the inverted L type will radiate more strongly in the direction opposite to which the free end points. This, however, is only the case when the flat top portion of the aerial is considerably longer than the vertical portion. Similarly, a receiving aerial receives best when the free end points opposite to the transmitting station.

Ques.—(3) Would the aerial described in Query No. 1 be suitable for the reception of signals from high power stations if a loading coil was used to increase the wave-length?

Ans.—(3) During the night hours with a very sensitive receiving set, such as described on page 82 of the book "How to Conduct a Radio Club," you will be able to hear high power stations, using damped or undamped oscillations, located within the borders of the United States.

Ans.—(4) The wireless telegraph aerial erected on top of the barn will in no wise interfere with the lightning rod. As a matter of fact, if the aerial is "earthed" during the periods it is not in use, it should in itself make an efficient lightning rod.

The stations you heard with the call letters having the prefix are not high-power stations, but are amateur stations located in your district. A copy of the book entitled "Radio Stations of the United States," can be purchased from the Government Printing Office, at Washington, D. C., at a price of fifteen cents a copy. This book gives a complete interpretation of the call letters of amateur and commercial stations. The additional licenses granted from month to month, are given in the monthly bulletin of the National Amateur Wireless Association.

* * *

A. J. T., Whitewright, Tex., inquires:

Ques.—(1) To become a member of the National Amateur Wireless Association must an applicant own a set of wireless instruments?

Ans.—(1) No; it is merely necessary for him to state that he is interested in wireless telegraphy, has some knowledge of the fundamentals and is to a certain extent familiar with the national regulations. The Association will naturally appeal to the owners of amateur apparatus.

* * *

J. E. K., Newport News, Va., inquires:

Ques.—(1) I recently completed the construction of a ½ k.w. transmitting set and as an earth connection employed a single conductor of No. 4 copper wire having a total length of about 25 feet terminating on a water pipe in the wireless room. My station is located on the second floor and when the transmitting set is in operation, sparks can be drawn from the gas of the heating system in any part of the house. As a rule this indicates an earth connection of insufficient carrying capacity, but I cannot believe that this is the case at my station. As an experiment I grounded both the gas and the heating system, but this did not give any relief. Now these sparks are not very harmful, but they are objectionable to the other persons in the house. Kindly give an explantion and remedy for the trouble. I might explain further that I use a very loose coupling in the oscillation transformer.

Ans.—(1) It is likely that the water pipes do not give a good earth connection and be-

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ing in inductive relation to the steam and gas pipes of your house they set up these potentials by electrostatic induction. A good method for the elimination of this trouble would be to run a piece of copper ribbon, about 2 inches in width, direct from the earth connection of the oscillation transformer to the water mains on the street side of the water meter. It may also be that the gas and water pipes of your house are in the electro-static field of your aerial and in consequence you experience these results. Swing the aerial away from the house and run a special earth connection from the apparatus out of the window to an earth connection in such a manner that it will not be in inductive relation to the pipes of the house.

* * *

B. W. M., Mobile, Ala., inquires:

Ques.—(1) What size of wire is used on the primary and secondary winding of the type E United Wireless receiving set?

Ans.—(1) The primary and secondary windings are covered with No. 26 S. S. C. copper wire.

Ques.—(2) What is the capacity of the varible condenser con ected across the secondary winding of this set?

Ans.—(2) The maximum value is .001 microfarad.

Ques.—(3) What changes would you suggest in the design of this receiving set to allow it to work properly with a vacuum valve?

Ans.—(3) To get the best results with a vacuum valve detector for the longer range of wave-lengths, say, of 3,000 or 4,000 meters, a loading coil should be connected in series with the secondary winding. In fact such values of inductance should be used at all wave-lengths that only very small values of the secondary condenser are employed. If the capacity of the secondary condenser exceeds .0005 microfarad, the potential to the grid is lowered.

Ques.—(4) If the leads of an umbrella aerial are brought in from the highest point would louder signals result if the lower ribs are all connected together as per the enclosed diagram?

Ans.—(4) Good results will be obtained with either connection, although it is sometimes deemed desirable to connect the lower ends of the umbrella together.

* * *

H. L. S., Fenimore, Wis., inquires:

Ques.—(1) Would an aerial system placed five feet above the earth, extended outward to a distance of 200 to 700 feet, be efficient for receiving purposes?

Ans.—(1) With an aerial of this type messages have been received several hundred miles from stations employing wave-lengths between 6,000 and 9,000 meters. It has been reported in the Proceedings of the Institute of Radio Engineers that with a similar aerial several hundred feet in length messages have been copied on the Pacific coast from high power-stations on the Atlantic coast.

Ques.—(2) What is the wave-length of my aerial, which is composed of 4 No. 14 wires, spaced 2 feet apart? It is 40 feet in height on one end, 50 feet in height on the other and 67 feet in length. It is of the T type.

Ans.—(2) Approximately 120 meters. It is difficult to say just how far the apparatus described will permit messages to be received, but it seems likely that you should have no difficulty in hearing prominent stations, located in the Great Lakes District, during the night hours.

* * *

C. W. D., Indianapolis, Ind.:

Careful consideration of your communication prompts us to give the following advice: If the lead-ins from your aerial lie parallel to the power mains, it will be a difficult matter to protect the lighting circuits of your house. You are advised, if possible, to place the lead-ins at right angles to the power wires or at least remove them to the furthest possible distance. The fact that your protective resistance rods become hot proves that they have an insufficient value of resistance for the potential of the power mains. Try connecting two 1 microfarad condensers in series, grounding them at the middle point. You might also try graphite resistance rods of 4,000 or 5,000 ohms. Although these devices will aid in conducting the induced potentials to earth, complete freedom cannot be expected as long as the aerial wires are allowed to remain in inductive relation to the power wires. The constant blowing of fuses by your high potential transformer would seem to indicate an imperfect design. A closed core transformer, without a magnetic leakage gap, is apt to consume an abnormal value of current, unless the precaution to fit the primary circuit with a reactance coil is taken. The actual dimensions for a suitable reactance coil depend upon the design of the transformer, but you should have no difficulty in devising one that will permit close regulation of the current flowing through the primary circuit.

* * *

N. W. B., Pittsburgh, Pa.:

An aerial of the T type, having the dimensions set forth in your query, has a fundamental wave-length of approximately 150 meters.

A receiving tuner, strictly suitable to the reception of time signals from Arlington, is described in the National Amateur Wireless Association bulletin for January. This tuner can be made responsive to amateur signals by breaking up the continuity of the primary and secondary windings at three different points, i. e., by fitting them with dead-end switches, keeping in mind the dimensions of the usual amateur aerial. Only a very few turns are required at the primary of the oscillation transformer to place the receiving tuner in resonance with the 200-meter wave. The average amateur aerial has a fundamental wave-length in excess of 200 meters, thereby calling for

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the use of a short wave condenser to place the antenna system in resonance.

If the secondary winding is shunted by a condenser having a capacity of at least .001 microfarad the panel type receiving set, described in the October, 1915, issue of THE WIRELESS AGE will be suitable for the reception of time signals from Arlington.

The fact that the condenser connected in shunt to your secondary winding has no effect on the received signals indicates that there is an open circuit in the connections of the condenser. If the plates of the condenser were in contact the signals would disappear.

* * *

J. B., Jr., Baltimore, Md.:

The receiving tuner described in the bulletin of the National Amateur Wireless Association for January is responsive to wave-lengths of 3,000 meters and is particularly recommended for your requirements.

Your second query is not clear. There is no difference in the connections of an open core or closed core transformer in so far as either the primary or secondary winding is concerned.

The call letters WIE have been assigned to the steamship Edward L. Doheny. The call letters KFI are assigned to the barge I. D. Fletcher.

It is not an easy matter to secure a high spark note from an electrolytic interrupter operated from a 60-cycle source of supply. The spark note can be smoothed out by placing a liquid rectifier in series with the alternating current source of supply, changing it to a direct current. Beyond this we can not offer advice.

* * *

P. D. M., Emens, Pa.:

You will not be able to use the full output of your transformer, rated at 1 k.w. with a 20,000-volt secondary, at the restricted wave of 200 meters. The closed circuit condenser should have a capacity of .008 microfarad. A plate of glass, 14 by 14 inches, covered with foil, 12 by 12 inches, the glass being ⅛ of an inch in thickness, will have a capacity of approximately .002 microfarad each. Eight plates connected in parallel will give a capacity of .016 microfarad, but taking into account that the voltage of the transformer is 20,000 volts, you require 2 banks in series. You should, therefore, connect 8 plates in parallel in each bank and the two banks in series, which will give a resultant value of .008 microfarad.

To take care of the entire output of the transformer, the capacity of the condenser might be increased to .02 microfarad, but the wave-length of the closed circuit with a single turn in use at the primary of the oscillation transformer will be considerably in excess of 200 meters.

With a condenser of .008 microfarad capacity and extremely short connecting leads to the spark gap and oscillation transformer, approximately 2 turns of the primary winding can be included in that circuit. This will be sufficient for the transfer of energy to the antenna circuit.

If two equal banks of condensers are connected in series the resultant capacity is one-half of one bank. But with two unequal banks of condensers connected in series, the resultant value is the reciprocal of the sum of the reciprocals of the separate units, or, in other words,

$$C = \frac{1}{\frac{1}{C\text{-}1} + \frac{1}{C\text{-}2} + \frac{1}{C\text{-}3}, \text{ etc.}}$$

Where C = resultant capacity in microfarads.

C-1 = the capacity in microfarads of one bank.

C-2 = the capacity in microfarads of the second bank.

C-3 = the capacity in microfarads of the third bank.

* * *

J. F. R., Philadelphia, Pa.:

An aerial of the inverted L type, 90 feet in length by 40 feet in height, composed of six wires spaced 2 feet apart, has a fundamental wave-length of approximately 240 meters. The distance you may expect to cover with a ¼ k.w. transformer, depends upon the local conditions surrounding your station and the type of apparatus used at the receiving station. The range of amateur stations varies widely. Reports are often received at this office that even with the restricted wave of 200 meters, from 400 to 800 miles are covered during the night time. The daylight range of the average ¼ k.w. apparatus does not exceed thirty to forty miles. Similarly, it is difficult to prophesy the range of a receiving equipment, but with the apparatus you describe in connection with the foregoing aerial, you should hear, during the night hours, stations on the Atlantic coast. Your receiving tuner is not quite applicable to the reception of Arlington time signals, but you should hear stations operating on wave-lengths up to 1,600 meters.

* * *

A. D. Middlechurch, Manitoba, inquires:

Ques.—(1) Is the discharge from a transformer with a secondary potential of 25,000 volts as dangerous as a current of that voltage direct from a generator? If not, why not?

Ans.—(1) With similar frequencies, the effect would be identical in either case; both being considered dangerous to human life. We have never heard of a generator that gave a potential of 25,000 volts direct from the armature.

Ques.—(2) Is it possible to use a telephone induction coil or a medical coil for wireless transmission? Which of the two would be the better?

Ans.—(2) If the secondary potential of the coil is sufficient to give a spark discharge, it

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can be used as a radio transmitter. The one giving the highest voltage should be employed. Special information concerning the diagram of connections, etc., is given in the book "How to Conduct a Radio Club."

J. P. R., Yonkers, N. Y., says that with several amateur aerials of various types connected together he is enabled with ordinary receiving apparatus and crystalline detector to hear the signals from Tuckerton, N. J., between eleven and twelve o'clock each night. In view of the fact that this station operates with undamped oscillations he does not understand why he receives the signals. Our comments on the phenomenon follow:

The Tuckerton station employs the Poulsen arc generator and Goldschmidt alternator at alternate schedules. When the antenna is supplied with oscillations from the arc set the waves are not genuinely undamped; in fact there are slight inequalities in the successive amplitudes of the oscillations which have a slight damping effect on the radiated energy making the signals audible even with crystalline detectors. Again, the phenomenon may be that described in a previous issue of THE WIRELESS AGE. With a certain degree of coupling between the primary and secondary windings of a receiving tuner and the antenna circuit adjusted to resonance with a given station using undamped oscillations, currents of two frequencies may be set up in the associated receiving circuit with just sufficient difference in periodicity to cause the phenomenon of "beats," making audible the signals. Similar effects have been noted in many amateur stations within 100 miles of Tuckerton.

* * *

A. M. L., Jr., Rochester, N. Y.:

The 80-foot aerial raised to a height of 55 feet above the earth has a natural wave-length of approximately 248 meters and a capacitance of .00033 microfarad. The second aerial with the flat top portion 200 feet in length has a natural wave-length of approximately 365 meters, and a capacitance of .0006 microfarad. If joined in parallel at the receiving apparatus the resultant capacitance will be that of one plus that of the other.

An inductively-coupled receiving tuner responsive to wave-lengths between 5,000 and 12,000 meters is fully described in the book "How to Conduct a Radio Club." The apparatus described is particularly designed for the vacuum valve detectors. If it is to be used with a crystalline detector, it is recommended that the inductance value described in that issue be reduced and the necessary wave-length adjustment in the secondary circuit obtained by connecting a large variable condenser in shunt to the secondary winding. A few experiments will reveal the correct ratio of inductance to capacity for the best signals.

* * *

J. D. F., Ashland, Neb.:

The proposed aerial, 3,000 feet in length, will give the best signals from long distance stations located in the United States and abroad. It will have a fundamental wave-length of approximately 4,400 meters.

Concerning the resistance of the telephones for long distance receiving you should be guided by the following rules: If the receiving detector is one of high resistance and makes use of a small local battery current then a high resistance telephone should be provided. However, it is not the resistance of the telephone which determines the sensibility; it is the overall construction as well. The general run of crystalline detectors, with the exception of the crystaloi, require a telephone of about 2,000 ohms. With the three-element vacuum valve detector, telephones of from 75 to 3,000 ohms resistance may be employed. Practically equal results will be obtained with phones of any resistance lying between these values, provided the telephone is well constructed. The vacuum valve detectors generally make use of a considerable value of potential in the local circuit and in consequence the resistance of the telephones is not so important. Keep before you the fact, that the 3,000-foot aerial is not suitable for the reception of signals from stations employing wave-lengths between 600 and 1,600 meters. In fact it is of no value except for stations employing wave-lengths in excess of 4,000 meters.

Regarding the equipment: You already are supplied with a vacuum valve detector and are advised to connect it in the circuits of a supersensitive receiving set such as described in the book "How to Conduct a Radio Club." Duplicate the coils described in that article and after a series of trial experiments you will undoubtedly find that your station will be responsive to signals at a distance of a few thousand miles.

* * *

J. F., Irvington, N. J.:

The information requested concerning the vacuum valve detectors is contained in full in the book "How to Conduct a Radio Club."

* * *

C. S., Indianapolis, Ind., writes:

Ques.—(1) Please advise how to construct a receiving transformer of the navy or rotary type that will tune to 16,000 meters and over. If there are any sliders used please tell me and make a diagram showing connections of the sliders (transformer to be of loose coupled type).

Ans.—(1) See the reply to the query of J. A. M., Milford, Utah, in the Queries Answered department of THE WIRELESS AGE for December, 1914. No sliders are necessary. Use multiple point switches.

Ques.—(2) Would I obtain better results if I used the multiple tuner described in the August, 1915, issue of THE WIRELESS AGE with the transformer referred to and also with a Blitzen loading coil?

Ans.—(2) You would secure a greater degree of selectivity if you used the multiple tuner, but not necessarily increased strength of signals.

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# National Amateur Wireless Association

## OFFICERS OF THE ASSOCIATION.

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Editor, THE WIRELESS AGE.

MANAGING SECRETARY,
Clayton E. Clayton,
450 4th Avenue, New York.

A national organization of wireless amateurs was announced in the October, 1915, number of THE WIRELESS AGE. Further details of the organization are given in an address made by J. Andrew White, which was published in the November WIRELESS AGE. Reprint copies sent upon request.

## MEMBERS' EQUIPMENT.

**1st. CERTIFICATE OF MEMBERSHIP.**

The handsomely steel-engraved Certificate, with shadow background half-tone, is sealed and signed by Officers, with the endorsement of Senatore Marconi, as President. Every member will want to frame and place it alongside of his Government License certificate, two documents establishing status as wireless amateurs.

**2nd. AERIAL PENNANT.**

The 36 inch aerial pennant, painted in four colors on scarlet felt, will stand long service at your aerial mast head. Every member will be proud of the National Insignia flying from his aerial.

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**3rd. MEMBERSHIP PIN.**

**The National Amateur Wireless Association Pin in gold and enamel is the National emblem of the Association. The design shown on the preceding page can but faintly describe its handsome appearance in three colors and gold. The pin has a special patented hub and shank which permits it being securely fastened on the coat lapel or on the vest without turning upside down.**

**4th. LIST OF RADIO STATIONS OF THE WORLD.**

**Revised Edition just published. See advertisement. Regular 50c edition.**

**5th. HOW TO PASS U. S. GOVERNMENT WIRELESS LICENSE EXAMINATIONS.**

**Regular 50c edition of this popular book. Members who already have a copy, see concessions below.**

**6th. HOW TO CONDUCT A RADIO CLUB.**

**This splendid book, which has been months in preparation and incorporates portions of articles running under the same title in THE WIRELESS AGE, is re-written to cover every new development, and with a large proportion of new matter. It is the foundation stone of the National Amateur Wireless Association activities. Price of this book 50c.**

**7th. MONTHLY BULLETIN SERVICE.**

**It is intended to make the monthly bulletin service for members of the National Amateur Wireless Association one of the most important features of the Association. This bulletin is to be used in connection with "List of Radio Stations of the World" described above. It will carry all additions (both amateur and commercial) to "List of Radio Stations of the U. S.", issued by the Bureau of Navigation, U. S. Department of Commerce, and secured for members at 18c a copy. The Government list is issued only once a year. The Association Bulletin will keep both lists up to date for you month by month, and in addition, will carry other special and invaluable Association features not obtainable elsewhere**

**8th. ONE YEAR'S SUBSCRIPTION TO THE WIRELESS AGE.**

**THE WIRELESS AGE is the Official Organ of the National Amateur Wireless Association and will contain full reports of wireless amateur activities, both national and local. It is planned to give published recognition to individual amateur achievement.**

## CONCESSIONS:

Those who, *during the past six months,* have become subscribers to THE WIRELESS AGE, or have renewed their subscription, or have purchased any portion of the Membership Equipment, may consider such payment as partial payment of Membership Application as given below. If you have paid for a subscription to THE WIRELESS AGE which includes books which are not a part of the Membership Equipment, then you may credit $1.25 of the remittance as partial payment on the Membership. For example, you may have remitted $2.25 for the combination offer of the 1915 Year Book with one year's subscription to THE WIRELESS AGE. In this combination, the price of both the book and the subscription was reduced, to make the special offer; therefore, you may be credited only with that part of the payment which went to the magazine—that is, $1.25. *Coupon subscribers receive no credit for trial orders.* Subscribers to THE WIRELESS AGE who *began or renewed more than six months ago,* will secure through Membership dues a renewal for another year; and their subscriptions will be extended for one year from the time the present subscription expires.

## INITIATION FEE

An initiation fee of $1.00 is required of all new members to pay for the initial membership equipment, consisting of Nos. 1, 2, 3, 4, and 5.

## ANNUAL DUES

The annual dues are to be not more than $2.00. For this, all members are to receive:

1st. The Monthly Bulletin Service.

2nd. THE WIRELESS AGE for one year.

3rd. How to Conduct a Radio Club or equivalent.

4th. 10% discount on any book on wireless published, and other features to be announced later.

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**SPECIAL NOTICE REGARDING CORRESPONDENCE.**

**As the National Amateur Wireless Association is in no sense a money making enterprise, and as the nominal dues will cover a very small amount of handling expense, it is desired that the correspondence be limited to only the most essential necessities.** A cordial invitation is extended to all club officials to write on matters pertaining to organization. This invitation also includes those who are interested in starting new clubs.

**Charters** Out of the amount paid by each member for annual dues, it is purposed to allow organizations that have become part of the National Amateur Wireless Association a rebate of 50 cents out of each $3.00 for their own treasury—a fund to take care of local expenses. Please note that this is a rebate, not a deduction. In order to qualify for recognition as a unit in the National Amateur Wireless Association, a club must have at least five active members and at least one-quarter of its total membership become members of the National Amateur Wireless Association. Clubs securing a charter will have representation in the National Council; this means that they elect their own delegate and thus secure a voice in the management of the Association and in the planning of its future development and activities.

**Clayton E. Clayton, Managing Secretary,**
**450 4th Ave., New York.**

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**Checks and money orders should be made payable to: Natl. Amateur Wireless Assn.**

**APPLICATION FOR MEMBERSHIP.**

CLAYTON E. CLAYTON, Managing Secretary,

NATIONAL AMATEUR WIRELESS ASSOCIATION, Date.....

450 4th Avenue, New York City.

As I desire to receive full recognition as an amateur wireless worker of the United States, I ask the privilege of enrollment as a Member in the National Amateur Wireless Association and request that you send me the complete Members' Equipment for which I enclose herewith remittance of $1.00 Initiation Fee, covering Initial Equipment, and $2.00 for First Annual Dues—or $3.00 in all. Option.*

I trust that you will act upon my application promptly and forward the equipment to me at the earliest possible date.

My qualifications for membership are given in blank spaces below.

Signature ..... Age.....

Street Address .....

Town and State.....

Please credit me with $..... paid for.....

* Option.

In the event that an applicant is unable to send the entire amount of the membership dues with this application, the figure $3.00 may be crossed out and $1.00 written in its place. This will be considered an agreement on the part of the applicant accepted for Membership that the balance of dues ($2.00) will be paid at the rate of 50c per month for the next four months, at which time pin, pennant and Certificate of Membership will be issued. The other equipment will be sent at once.

**FILL IN ANSWERS TO THESE QUESTIONS.**

1—Have you a Government License (give number.....) or do you purpose applying for one?.....

2—If you are under 21 years of age, give names of two adults for references as to character.

Reference.....

Reference.....

3—If you are a member of any Local, State or Interstate wireless club or association, give its name, and name of Secretary with address.

.....

4—Are you now a subscriber to THE WIRELESS AGE?.....

5—If you already have any books included in the equipment, state which ones.....

.....

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# National Amateur Wireless Association

A DIRECTING ORGANIZATION DEDICATED TO THE PROMOTION OF RADIO COMMUNICATION

CALL LETTERS 9PY
S. W. PIERSON
CARROLLTON, ILLINOIS

GUGLIELMO MARCONI, PRESIDENT

Reduced fac-simile of letter head.

## For Clubs and Members of National Amateur Wireless Association

The following list of items of optional equipment is listed at cost price in order to give members and clubs of the Association every material advantage in the way of a complete equipment that may be desired. Prices include transportation charges to 5th Parcels Post Zone. Postage extra to 6th, 7th and 8th Zones.

**LETTER HEADS AND ENVELOPES:**
100 National Association Letter heads with imprint of member at left hand side, as illustrated above 75c
Without member's imprint..... 35c
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**MESSAGE BLANKS:**
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**CLUB PENNANTS:** Made of first quality wool bunting, letters and emblem sewed on with cut outs in color and name of club added, prices on application.

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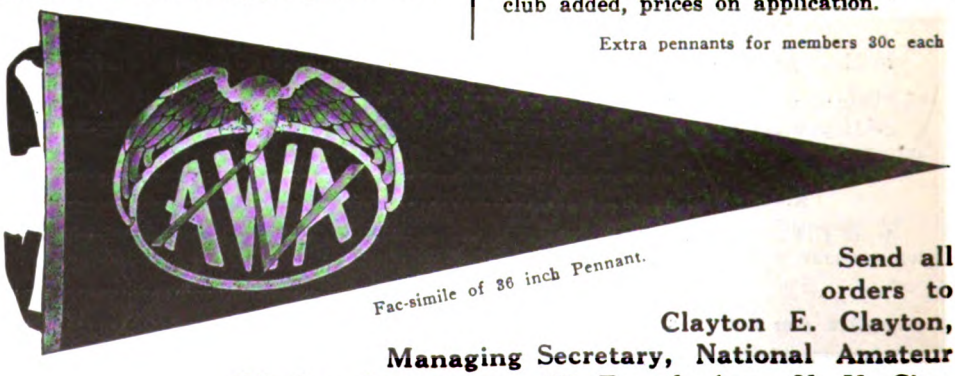


Fac-simile of 36 inch Pennant.

Send all orders to Clayton E. Clayton, Managing Secretary, National Amateur Wireless Association, 450 Fourth Ave., N. Y. City.


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# THE WIRELESS AGE

Owing to the fact that certain statements and expressions of opinion from correspondents and others appearing in these columns from time to time may be found to be the subject of controversy in scientific circles and in the courts, either now or in the future, and to sometimes involve questions of priority of invention and the comparative merits of apparatus employed in wireless signaling, the owners and publishers of this magazine positively and emphatically disclaim any privity or responsibility for any statements of opinion or partisan expressions if such should at any time appear herein.

JUNE, 1916

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# Some Problems in Antenna Construction

PART I

By A. S. Blatterman, B.Sc.

IN constructing a wireless telegraph aerial the engineer is confronted with two problems. The first of these relates to the mechanical strength of the antenna and its supports; the second to the electrical components. These two problems subdivide themselves, as follows: Under the first heading we consider the strength of the wires with the concomitant sag and tension and the pull imposed on the supporting structures, the stresses produced therein and the deflection under load, wind pressure, ice and sleet; in the second case, we must incorporate into the antenna a certain electrostatic capacity, and consideration must be given to the potential of the system in regard to losses through corona or brush discharge, and to some other points which will be discussed later.

It is of prime importance to make the antenna mechanically strong. In the design of a span of wire two problems are presented:

1. At what tension (or sag) must the wire be strung in order that the tension in the span may not exceed a definite limit under the worst conditions of temperature and extra mechanical loading (due to ice and wind)?

2. What will be the maximum vertical sag of the wire for a given variation in loading and temperature?

The important factors which enter into these two problems are the following:

1. *The length of the span.*
2. *The material of the wire.*
3. *The size of the wire.*
4. *The coefficient of linear expansion of the wire.*

For copper this coefficient is 9 by $10^6$ and for aluminum 12.8 by $10^6$, the temperature being expressed in degrees Fahrenheit. For phosphor-bronze it is 17.7 by $10^6$.

5. *The modulus of elasticity of the wire.*—The modulus of elasticity is the increase in tension in pounds per square inch that is required to produce an elongation of one unit in every unit of length of the material (if the material did not change its properties during the process). Thus, for a copper wire whose cross-section is one square inch, it requires from 12 by $10^6$ to 16 by $10^6$ pounds to cause an inch of the wire to stretch one inch, depending upon the quality of the wire and upon whether the wire is stranded or solid. We may take $M = 12$ by $10^6$ for copper, $M = 14$ by $10^6$ for phosphor-bronze, and $M = 9$ by $10^6$ for aluminum.

6. *The maximum tension in pounds per square inch to which the wire may be subjected.*—The maximum allowable tension is usually taken as one-half the ultimate tensile strength of the wire, or about 30,000 pounds per square inch for copper, 55,000 pounds per square inch for phosphor-bronze, and 14,000 pounds per square inch for aluminum. The tension in pounds per square inch is, of course, the total pull on the wire in pounds divided by the cross-sectional area of the wire in square inches.

7. *The maximum external load to which the wire may be subjected due to the collection of sleet on the wire and the pressure of the wind against it.*—It is usual in the northern part of the United States to assume the maximum loading as that due to an ice coating of 0.5 of an inch thick all round the wire, plus a wind pressure of eight pounds per square foot of the projected area of this ice cylinder. (See Fig. 1.) The wind pressure in pounds per square foot of projected area is calculated by the formula:

$$P = 0.0024\ v^2 \quad \ldots\ldots\ldots\ldots (1)$$



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where P = pressure in pounds per square foot.
V = actual wind velocity in miles per hour.
Thus, for a 60-mile wind,
P = 8.65 pounds per square foot.

8. *The minimum temperature at which the maximum external load occurs.*—Of course, for a given span, the wire is shorter and the tension greater at low temperatures than at high ones. However, it is a fact that sleet seldom exists on a wire when the temperature is much below freezing; nor, for that matter, is it usual to have a heavy sleet on the wire, together with maximum wind velocity.

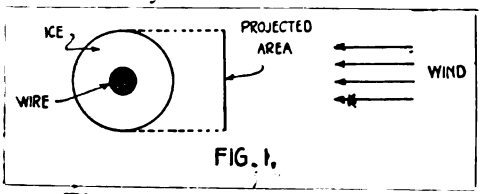

FIG. 1.

9. *The temperature at which the wire is to be strung.*

10. *The maximum temperature to which the wire is apt to be subjected.*—It should be noted that the temperature of a wire exposed to the sun is considerably higher than the temperature of the surrounding air.

The following formulas take into account all of the various quantities mentioned above in a comparatively simple yet accurate way. For a development of the formulas the reader is referred to a paper by Dr. Harold Pender, Proc. A. I. E. E., July, 1911.

*Supports at the same level.*—We will consider first the case in which there are two supports so arranged that the two ends of the wire are at the same elevation. (See Fig. 2.)

The symbolism is as follows:
w = weight of wire per foot (pounds).
d = diameter of wire in inches.
i = ice thickness in inches.
v = wind pressure (pounds per square foot).
K = a constant depending on the loading.

$$\sqrt{\left\{1+\frac{1.24\,i\,(d+i)}{w}\right\}^2+\left\{\frac{v\,(d+2\,i)}{12\,w}\right\}^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

If ice is neglected then

$$K=\sqrt{1+\left(\frac{vd}{12\,w}\right)^2} \quad \ldots\ldots (3)$$

Again if
m = weight in pounds of bar of conductor 1 foot long and 1 square inch in cross-section.
T = tension in wire (in thousands of pounds per square inch).
D = deflection in feet.
$p=\frac{100\,D}{L}$ per cent. deflection.
K′ = value of K when there is no wind. = 1 when there is no ice.
M = modulus of elasticity.
$\alpha$ = coefficient of expansion.
$t_0$ = lowest temperature in winter.
t = highest temperature in summer.
We have:

$$D=\frac{KmL^2}{8000\,T} \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

$$P=\frac{KmL}{80\,T} \quad \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Taking into consideration the temperature effects:

$$\left(P^2-\frac{3.75\,T\,10^6}{M}\right)-\left(P_0^2-\frac{3.75\,T_0\,10^6}{M}\right)=3750\,(t-t_0) \quad \ldots\ldots\ldots\ldots (6)$$

where

$$P_0=\frac{K_0\,mL}{80\,T_0} \quad \ldots\ldots\ldots\ldots\ldots\ldots (7)$$

$T_0$ = tension in thousand pounds per square inch at temperature $t_0$.

$K_0$ = value of K for the loading assumed at temperature $t_0$.

Hence, when the tension $T_0$ at temperature $t_0$ and the loading factor $K_0$ are known, the tension at any other temperature t and loading factor K may be determined by solving equation (6) for T, after substituting for p and $p_0$ their values as calculated by (5) and (7). The following example illustrates the use of the foregoing equations:

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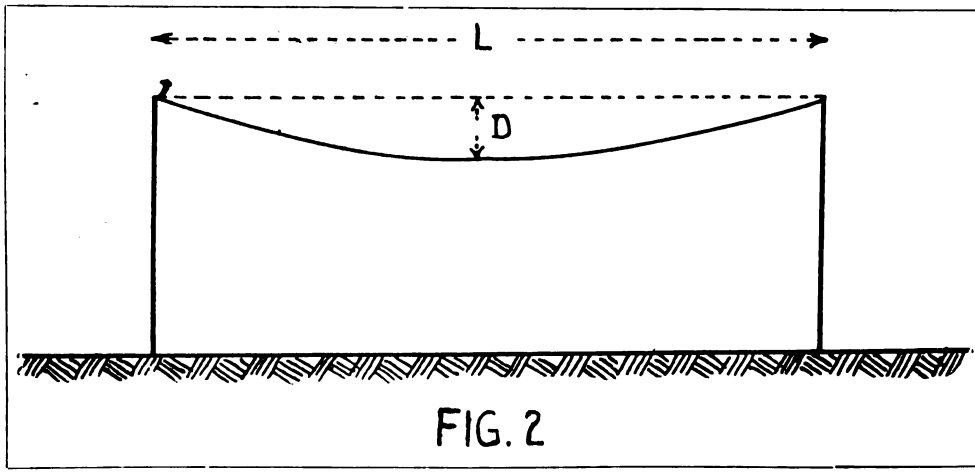


FIG. 2

Wire: 7 strand, No. 20 phosphor bronze.

$L = 320$ feet.
$w = 0.0189$.
$d = 0.121$.
$v = 10.5$ pounds per square foot (corresponding roughly to a 65-mile wind).
$m = 3.71$.
$M = 14 \times 10^6$
$\propto L = 17.7 \times 10^6$
$t_0 = 0°$ F.
$t = 100°$ F.

Ultimate tensile strength of conductor = 110,000 pounds per square inch.

At 0° F., no ice and no wind, allowing a factor of safety of 10, the allowable tension in the wire will be taken at 11,000 pounds per square inch. Hence,

$$T_0 = 11$$

and by (4):

$$D = \frac{1 \times 3.71 \times 320^2}{8000 \times 11} = 4.32 \text{ ft.}$$

Now for any other condition of loading we proceed as follows:

If we have ¼-inch ice and a 65 mile wind at the temperature 30° F., formula (2) gives:

$$K = \sqrt{\left\{1 + \frac{1.24 \times 0.25\,(.371)}{0.0189}\right\}^2 + \left\{\frac{10.5\,(.121 + .5)}{12 \times .0189}\right\}^2} = 8.9$$

By (7):

$$p_0 = \frac{1 \times 3.71 \times 320}{80 \times 11} = 1.35$$

By (5):

$$p = \frac{8.9 \times 3.71 \times 320}{80 \times T} = \frac{132}{T}$$

$t - t_0 = 30°$

and from (6):

$$\left(\frac{132^2}{T^2} - \frac{3.75\,T10^6}{14 \times 10^6}\right) - \left(1.35^2 - \frac{3.75 \times 11 \times 10^6}{14 \times 10^6}\right) = \frac{3750 \times 17.7 \times 30}{10^6}$$

$$\frac{17420}{T^2} - 0.268\,T = 0.865$$

from which

$$T = 39.2 \text{ or } 39{,}200 \text{ lbs per sq. in.}$$

This stress occurs at 30° F., ¼-inch ice, 65-mile wind, and is well below the elastic limit for phosphor-bronze, viz., 55,000.

The deflection under these conditions is by (4):

$$D = \frac{8.9 \times 371 \times 320^2}{8000 \times 39.2} = 10.8 \text{ feet}$$

Now, if we take as the worst condition of loading ¼ inch ice, 65 mile wind at temperature 0° F., then

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$$p = \frac{132}{T}, \quad p_0 = 1.35 \text{ (as before)}$$

$$t - t_0 = 0$$

by (6):

$$\left(\frac{132^2}{T^2} - \frac{3.75\ T10^6}{14 \times 10^6}\right) - \left(1.35^2 - \frac{3.75 \times 11 \times 10^6}{14 \times 10^6}\right) - 0$$

$$\frac{17420}{T^2} - 0.268\ T = -1.12$$

$T = 41{,}500$ pounds per square inch.

The deflection is:

$$D = \frac{8.9 \times 3.71 \times 320^\circ}{8000 \times 41.5} = 10.4 \text{ ft.}$$

We see thus the effect of temperature.

With max. ice and wind load at 30° ..... D = 10.8 feet

With max. ice and wind load at 0° ..... D = 10.4 feet

Also the effect of ice and wind load:

With ice and wind at 0°

D = 10.4 feet. T = 41.5

Without ice and wind at 0°

D = 4.32 feet T = 11.0

The increased load has raised the tension and stretched the wire, thereby increasing the sag.

*Supports at different levels.*—We now consider the case where the supports are at different levels. (See Fig. 3.)

T = tension at lowest point of span (*i. e.* at 0),

L = length of span: horiz. dist. between supports,

h = difference in level of supports,

$L_0$ = dist. to lowest point of span from lower support.

$$K' = 1 + \frac{1.24\ i\ (d + i)}{w} \quad \ldots\ldots\ldots (8)$$

As before, $K'_0$, $K_0$, $T_0$, $p_0$, are the values of these quantities when the temperature is $t_0$.

When the supports are at different levels we have:

$$\left(p^2 - \frac{3.75\ T10^6}{M}\right) - \left(p_0^2 - \frac{3.75\ T_0 10^6}{M}\right) - 3750\ \alpha \left\{(t - t_0) - \frac{h^2}{2\ \alpha L}\left[\left(\frac{K'}{K}\right)^2 - \left(\frac{K'_0}{K_0}\right)^2\right]\right\} \quad \ldots\ldots\ldots (9)$$

We also have:

$$L_0 = \frac{L}{2} - \frac{K'\ h}{4\ KD} \quad \ldots\ldots\ldots (10)$$

D is the deflection corresponding to the same length of span, same tension, and same loading, *but the two points of support are at the same elevation.*

Also:

$$D_1 = D\left(1 - \frac{K'\ h}{4\ KD}\right)^2 \quad \ldots\ldots\ldots (11)$$

In stringing the conductors it is necessary to know the temperature, the wind velocity (usually the work is done, if possible, when there is no wind

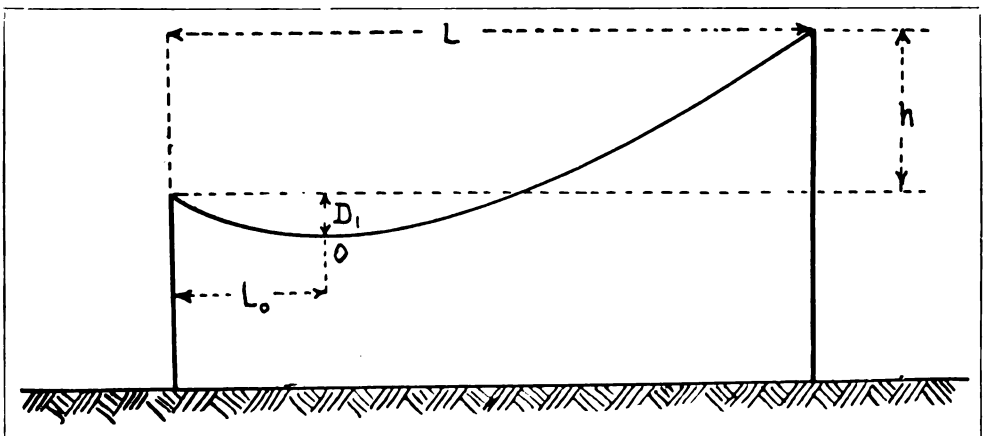


FIG. 3.

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and no ice on the wires), and the tension or sag that must exist under the given stringing conditions in order that the allowable tension and sag under the extreme maximum conditions of temperature and loading, after the wires are up, will not exceed specified limits. For this purpose a table is calculated by the use of the foregoing formulae, giving the tension and sag at various temperatures, and if desired a curve drawn from these data showing the tension to place on the wires or the sag to allow when the stringing is carried on at different temperatures.

The following table is calculated for the example for different temperatures assuming conditions of no ice and no wind.

| Temp. t° F. | Tension lbs. sq. in. | Pull lbs. | Sag. ft. |
|---|---|---|---|
| 80° | 6100 | 34.2 | 7.29 |
| 60° | 6900 | 38.8 | 6.88 |
| 40° | 7800 | 43.8 | 6.10 |
| 20° | 9100 | 51.1 | 5.22 |
| 0° | 11000 | 61.7 | 4.32 |

The third column is the pull in the wire; it is the tension in pounds per square inch times the cross-sectional area of the wire in square inches. If the wires are strung at 60° F., then a pull of 38.8 pounds must be used to put the wires in proper tension, this being such that under the worst condition of loading, namely ¼-inch ice, 65-miles wind, at 0° F., the tension will be 41,500 pounds per square inch, which is below the elastic limit. A dynamometer or some form of spring balance can often be used for this purpose.

If the antenna is composed of, say, eight wires, then the total pull on the supports at the temperature 60°, no ice and no wind, is 8 by 38.8 = 310 pounds. At 0°, no ice and no wind, it is 8 by 61.7 = 494 pounds. At 0°, ¼-inch ice and 65 miles wind, it is 1,865 pounds, and as this is the severest loading to be expected, the supporting structures must be designed to withstand this load.

*Wind Velocity.*—It is well to distinguish between indicated and true velocities. The United States Weather Bureau observations are made in such manner that the velocity indicated on the instrument is not the actual velocity. The true velocities corresponding to definite indicated velocities, as given by the United States weather reports, are as follows:

**Velocity: Miles Per Hour**

| Indicated. | Actual. |
|---|---|
| 10 | 9.6 |
| 20 | 17.8 |
| 30 | 25.7 |
| 40 | 33.3 |
| 50 | 40.8 |
| 60 | 48.0 |
| 70 | 55.2 |
| 80 | 62.2 |
| 90 | 69.2 |
| 100 | 76.2 |

In calculating wind pressures the actual velocity must be used.

**Summary**

1. Assume tentatively the allowable value of $T_0$ about 1-10 of the ultimate tensile strength of the conductor, at 0°, no ice, no wind.

2. Then assume maximum ice and wind loading, and temperature t at which these occur. Calculate p, $p_0$, K, $K_0$, K', $K'_0$.

3. Substitute in equation (6) and solve for T. This is the tension under the load conditions at temperature t.

4. If this is above the elastic limit of the wire a lower value $T_0$ at 0°, no ice, no wind must be used and the calculations repeated.

5. Calculate a table for different temperatures giving the pull in the wires to be used in stringing, or the sag, or both.

These determinations having been made, we shall discuss the matter of aerial supports.

*(To be concluded)*

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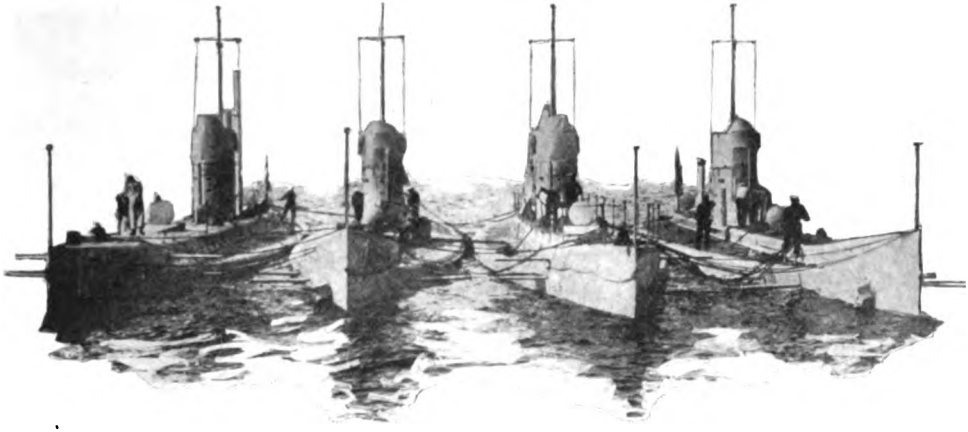

*German U-boats of an early period, with the wireless aerials strung port to starboard instead of fore and aft*

# The Wireless Equipped Submarine

"IT'S pretty good to be alive," observed a quiet looking man seated at an inconspicuous table in a restaurant in Longacre Square. He looked about him with enjoyment. A lively orchestra was in action; the scene was gay and animated, and its novelty pleased him. He was in civilian clothes. Nobody suspected that here sat a submarine lieutenant of one of the warring powers who, only a few weeks before, had lived through a vivid romance of the sea.

"Yes, it's great," resumed the speaker. "But do you know to what I owe my life today? Ether waves—in other words, the wireless." He leaned toward his companion over the table, and, lowering his voice, he told a remarkable story.

Only three weeks before, on a beautiful moonlit night, the submarine which he commanded was cruising "somewhere" in the war zone. The men on deck were watching, far in the distance, a handsome three-master under full sail. Suddenly the ship sank, and so quickly that they thought their eyes had deceived them. Then came the crash of a great detonation under water. Instantly the vanished sailing ship came up out of the water with masts and decks aflame. Thus she floated until the fire destroyed her.

"When we finally reached the scene of the wreck," continued the lieutenant, "I found one of our companion craft, and her commander explained the amazing performance.

"The sailing ship had refused to stop on signal, and he sent a shell into her. The vessel was loaded with a cargo of calcium carbide, he learned later from two members of the rescued crew, and when she sank the water action caused an explosion in her cargo of chemicals, the force of which sent the sailing ship to the surface again, setting her on fire and eventually destroying her."

The quiet speaker then related more of his submarine experiences. While the officers of the two undersea boats were talking of the effects of the explosion, the wireless operator on board the



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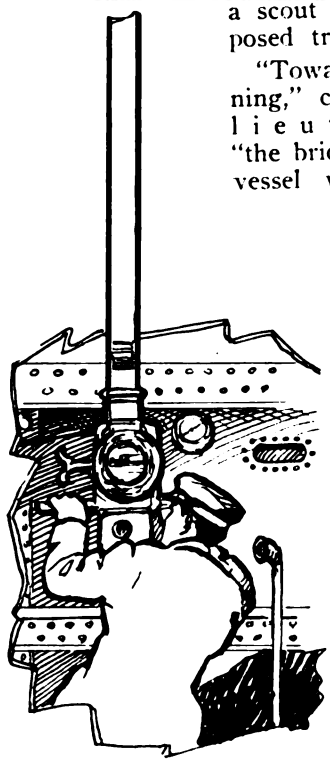
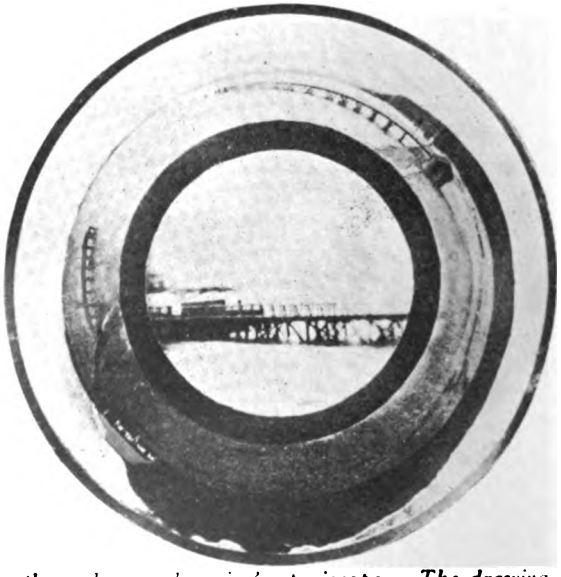
lieutenant's vessel was "listening in" on a wireless message which he had picked up. He at once reported that a steamship was not far away, which, judging from her wireless call, must be a transport. Use was made of the direction finder, and the two submarines at once parted company to go on a scout for the supposed transport.

"Towards evening," continued the lieutenant, "the bridge sighted a vessel without flags or lights, and nearby was a destroyer. The two craft were exchanging light signals, and observations made of the steamship betrayed her as the supposed transport. We dived at once, and from a distance of 300 meters shot a torpedo. Two strong detonations told the story that the target had been struck. When we rose to the surface, the destroyer had vanished, but far off we saw the transport in a sinking condition. We made all speed, but before we could arrive at the scene, she had gone down."

The lieutenant was silent for a moment. "We didn't distinguish her name at the time, but only recently she was reported by a certain Government as missing. We know now who she was."





*The circular photograph shows the view through a submarine's periscope. The drawing shows method of operation*

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The two fellow submarines were in the meantime keeping in wireless communication. They learned that, owing to their combined activities, a destroyer flotilla was on the way to hunt them down. "Two hours later," added the lieutenant, "my wireless operator reported that active wireless messages were being interchanged by enemy craft, which were trying to locate us. That caused us both to leave for a safer field of operations."

The lieutenant, however, only ran into a new danger and lost his boat. "How did it happen?" The officer shrugged his shoulders. "You'll have to excuse me. I haven't made my report as yet. At any rate, we lost three of our men, and the rest of us were picked up by a neutral steamer."

Through the grace of the friendly skipper, the men from the wrecked submarine were included as members of his crew, and eventually landed at Galveston. They later made their way to New York, and soon expect to be on their native soil again.

"Yes, we'll soon be back in the war zone, I hope," added the lieutenant. "But as I said, the wireles saved us, for if we had ever run into that destroyer flotilla it would have meant good-bye."

It is not so unusual for the sailors from the air and ocean fleets of the belligerent countries who have lost their vessels, to pass through New York on their mysterious journeyings. The lieutenant's story was simply told. But it was eloquent in showing that probably no application of wireless telegraphy in warfare has proved so valuable as that which is installed on the submarine.

In this it supports the widely recognized fact that the wireless equipped submarine is regarded by America's naval strategists as the principal seascout and guardian of our country's coast line. In this it is the comrade of the wireless equipped aeroplane, which fulfills a similar duty in warding off danger from the ocean outposts of our national defenses.

The submarine and the aeroplane are American inventions. It is appropriate, therefore, that these two engines of offense and defense should be utilized in the protection of our Atlantic and Pacific coasts from any menace to the national life.

This conception of the value of the wireless equipped submarine was ably handled by First Lieutenant Meade Wildrick, of the Coast Artillery Corps, recent winner of a prize offered for an essay on the effect and development of the submarine upon measures for coast defense.

"The coast defense submarine," said Lieutenant Wildrick, "although more closely connected to our problem of coast defense than the fleet submarine, is also essentially a naval weapon. This type of submarine is, however, more or less dependent upon the existence of our permanent seacoast defenses in that they protect the navy yards and provide the submarine with a safe base from which to operate. The vessels assigned to this duty would probably be selected from the latest types of coast defense submarines in commission. To effectively perform their duties, they would be divided into divisions, with the necessary auxiliary ships, and stationed at strategic points along our coast and in our outlying possessions. Their duty would be to guard the coasts of the United States and vigorously attack any hostile expedition approaching our coasts. These submarines cannot, as some ardent admirers would have us believe, sink every hostile ship that threatens our shores. Nevertheless, their presence would undoubtedly have a great moral effect upon an enemy and, when acting in conjunction with our other weapons of coast defense, they should certainly inflict considerable damage upon any hostile expedition.

"The distribution and operation of these coast defense submarines in guarding our coast is, of course, exclusively a naval problem. In performing this duty the naval authorities should, however, work in conjunction with the War Department to develop such a system that would enable the United States to meet a hostile landing at any point by an immediate concentration of

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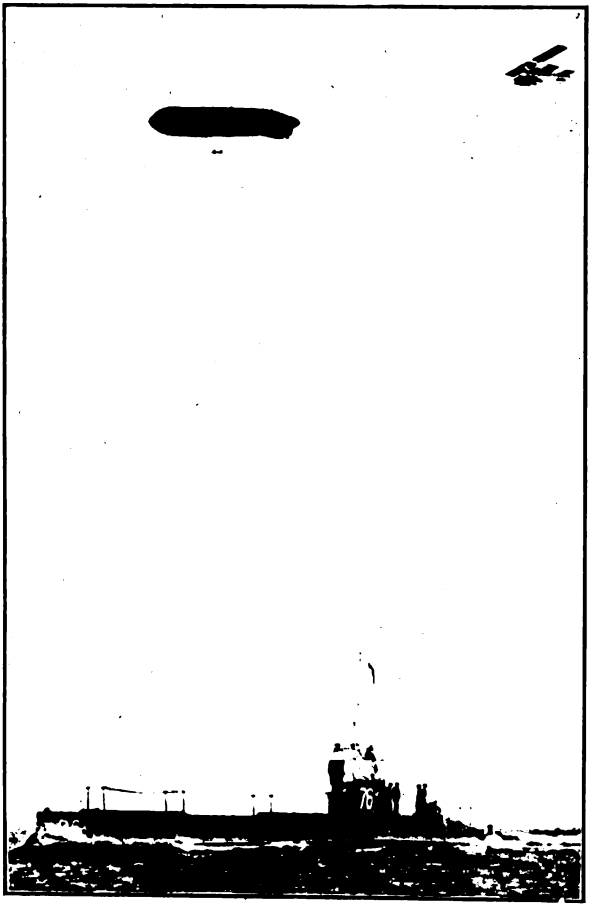

*The submarine and the aeroplane are American inventions. It is appropriate, therefore, that these two engines of offense and defense should be utilized in the protection of our Atlantic and Pacific coasts. The value of the wireless equipped submarine is explained in this article*

all its forces, namely, coast defense submarines, complete units of the mobile army, and heavy mobile batteries of coast artillery. To accomplish this result it would, of course, first be necessary to develop the coast patrol of scout aeroplanes and fast patrol boats. This patrol should have a complete wireless system of its own, that it may be able to discover the approach of the enemy a day or even two days before it could attempt to force a landing. The enemy will be at the greatest disadvantage when he is disembarking his troops and covering his landing operations. This is the first time, therefore, that we must be prepared to attack him from both land and sea with all the energy and strength we can command.

"The duties of the harbor defense submarines would, in general, be as follows: first, to attack hostile ships, whether in the vicinity of our coast defenses, or when they are attempting to enter our harbors; second, to reconnoiter the water areas in the vicinity of our coast defenses, and to discover the position and movements of the hostile ships. This information would be specially valuable to our coast defenses at night or in foggy weather, when the water approaches to our harbors are invisible from the shore. Timely information of sudden attack or run-bys under these conditions would be invaluable to the coast defenses in repelling such attacks."

In the rôle thus to be played by the harbor defense submarines, it is self-evident that their wireless equipment would be an important factor in the transmission of timely information of enemy movements. Such craft may best be described as pickets, in constant communication with shore stations by means of wireless. This view of their utility is also held by Simon Lake, creator of the Lake submarine.

Mr. Lake is one of those geniuses of distinctive American type, the pioneer explorers into the unknown regions of natural forces, such as Morse, the Wright brothers and Holland. Considerable authority therefore attaches to the words of Mr. Lake when he expresses the opinion that, after twenty-two years of continual study and experience in designing and building submarine boats and appliances in the United States and abroad, that these boats are to take a place, to which they are rightfully en-

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titled, as the mainstay of our national defense system.

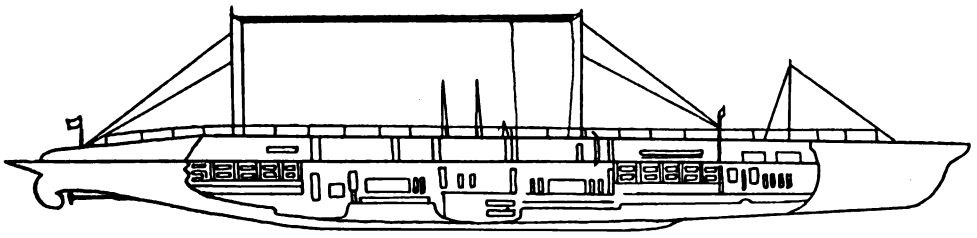
"Coast defense submarines," says Mr. Lake, "will probably be found to be the most important adjunct to any navy in every country whose policy it is to defend its own coast lines, rather than to become an aggressor. Vessels for this purpose do not need to be of great tonnage, nor of high speed. It is possible to get a speed of 14 or 15 knots in a submarine of about 500 tons displacement and at the same time have comfortable living quarters for the crew. A boat of this size may carry eight Whitehead torpedoes, each torpedo being capable of destroying a fifteen million dollar battleship, and as a 500-ton displacement submarine can be built for about a half million dollars and is capable of carrying eight Whitehead torpedoes, potentially good for eight $15,000,000, or a total of $120,000,000, worth of capital ships, it seems as if that would be sufficient to ask of one little submarine boat.

"A two and one-half million dollar boat for the defense of harbor entrances or seacoast cities would not carry as many torpedoes as five of the 500-ton boats. A torpedo fired from a small boat is fully as potent as one fired from a two and one-half million dollar boat. These small boats could be located at five different points on our coast, and the chances are that at least two of these smaller boats could reach an objective point on the coast line under their protection in shorter time than one large high-speed boat would be able to do. At the same cost, they could cover the same area of coast line to a much better advantage as there would be five of them distributed over that area instead of one."

Mr. Lake assumes for purposes of illustration that the Sandy Hook entrance to New York harbor is to be defended. He strikes a fifteen mile radius from Sandy Hook point, running from the Long Island to the New Jersey shore, and has four submarines take station on that radius line about five miles apart. "No ship," he says, "could pass that radius line without coming within the range of vision of the commander of the submarine. The oscillators, or microphones, now installed in all submarines, would readily detect the approach of a surface ship or ships. Communication by the Morse code, or other special codes, may be carried on by these between submarines up to a distance of several miles. It would be possible for groups of submarines on station, or picket duty, so to speak, to be in constant communication with shore stations, either by submerged telephone connections, or by wireless. In that way the submarines can be kept in constant touch with the country's scouting fleet of high-speed surface vessels or aeroplanes and immediately be notified of the approach of an enemy's fleet or ship.

"A ship to enter Sandy Hook, therefore, would have to run the gauntlet of five or six submarines without it being necessary for them to leave their stations."

The wireless installation on the small submarines thus described, intended as coast scouts and harbor protectors, differs as a rule from the wireless equipment of the larger types of undersea craft. The coast patrol submarines of the German Navy have a wireless equipment similar to the portable wireless apparatus used by the armies in the field.



*An American submarine cruiser, wireless equipped, designed by Simon Lake*

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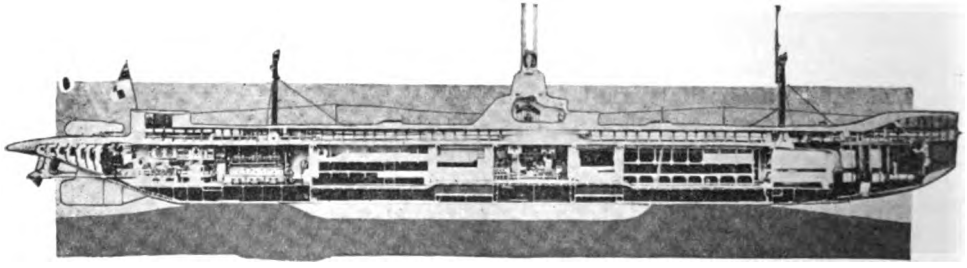
The aerial is strung from telescopic masts, and is made of bronze, so that it may not be corroded by sea water, the apparatus being located in the interior of the vessel. When the submarine makes preparations to submerge, these masts disappear from the deck, being wound up by the interior mechanism. In fact, about everything disappears from the deck, in this eventuality. A German, describing his trip on a modern U-boat, said: "On boarding the U-boat, the first object meeting the eye is a tower-like structure, one meter high, in which several windows are fitted. This is the conning tower, which permits entrance to the boat's interior. Fore and aft a flat, rather narrow deck joins this tower. The forward deck is somewhat higher than the afterdeck. When floating on the water, this deck is about one and one-half meters above the surface, and is surrounded by a low railing. Besides the tower, one also may observe on the deck a signal mast, the antennae of the wireless station, a flagstaff and several tubes, which serve as ventilators for the interior of the boat, and as vents for the escape of motor gases. All these objects, even the railing, are removed before the boat submerges and are stored below deck. Only the conning tower remains in its place."

On the larger U-boats, however, even the tower is telescopic in its upper part, and is partly withdrawn before the craft is submerged. On these larger U-boats, the wireless equipment consists of large collapsible masts, which are placed flush with the deck, or fastened to the sides of the vessel. The six German submarines completed during 1913-14, comprising U-25 to U-30, were vessels of 900 tons submerged displacement, with heavy-oil engines of 2,000 horsepower and electric motors of 900 horsepower. They had wireless telegraph apparatus on board and were specially constructed with long superstructures and high, collier-like bows to enable them to keep at sea in almost any weather. This type, however, since the war, has been greatly enlarged both as to size, motive power and radius of action.

Wireless adaptations on the German U-boats have been subject to a great variety of changes since the war began. The various modifications may be indicated in part in some of the photographs published with this article. In the picture of a cross-section of a German submarine of an early type, the U-1, the first submarine of the German navy, taken from the model in the German Museum in Munich, one may see the collapsible ventilator tube on the forward deck, to which was attached a wireless mast. This is one of the type in which not alone the ventilator but also the wireless mast, structured of bronze, is wound up into the interior of the boat before the process of submersion. It may be seen that the prow has a superstructure, intended to protect the compartment carrying the torpedo tubes, so that these might not be damaged in the event of collision or ramming. The principle on which German submarines have since been built has been to accentuate the length



*A cross section of a German submarine of an early type, the U-1, the first submarine of the German navy. Photograph of the model in Munich. The wireless mast was attached to the forward ventilator tube*

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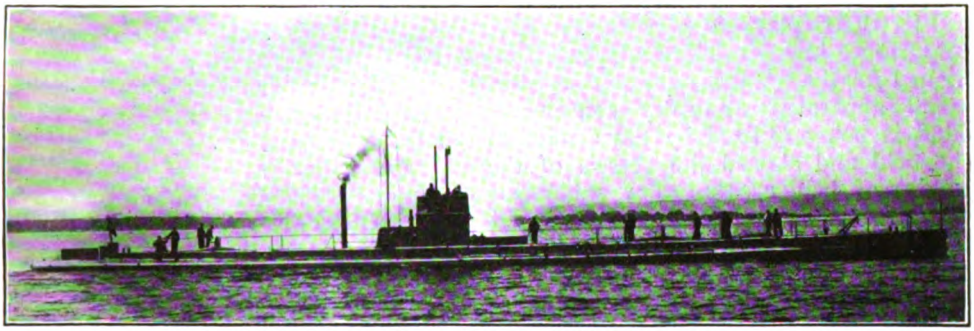
of this bow, so that in the U-boats up to date it has been greatly extended, affording further protection to the room in which the torpedomen are stationed.

In another photograph of a German U-boat are shown the collapsible tower and the collapsible masts of the wireless equipment. In a third photograph are shown four German U-boats of an early period, and of two different types, all supplied with wireless masts. Contrary to the principle adopted by other nations, the aerials are not strung from fore and aft, but from port to starboard.

It is a fact, however, that the German U-boats of the latest and most powerful types, those of 1,500 tons and a cruising radius of 6,000 miles, have adopted wireless masts fore and aft of the conning tower. Another system of aerial has since been adopted, which has never before been made known. It is one by means of which the U-boat, small as the craft may be, is enabled to receive communications from its home port in any part of the world. Two balloons, with a stiff rod between them, are sent into the air to a height of at least 2,000 feet. These gas bags are painted partly white and blue, to make them indistinguishable from the sky. With an aerial at this height, naturally, there is no limit to the scope of wireless communication. When an enemy vessel is sighted, the wires controlling the gas bags are slipped down by means of an electrical windlass. To this arrangement may be attributed many of the remarkable achievements of the U-boats in warfare.

The British submarines of the "E" type, completed during 1912-14, are fine ocean going craft. More powerful than their predecessors, and also equipped with wireless apparatus, they are able to keep at sea in almost any weather.

In the American type of Holland boat, when preparation is made for a diving operation, the Kingston valves—or air-pressure valves—are tried, to see that they are in working order; meanwhile the deck is cleared of stanchions, and the wireless mast is turned down out of the way. As a rule this mast is lashed to the sides of the boat. All hatches are closed and water is admitted to the tanks until the deck, which is just below the base of the conning tower, is at the level of the water.



*The modern German U-boat, officially designated as the latest available photograph of the new type of submersible with a cruising radius of several thousand miles. The recently constructed German submarines, photographs of which could not be obtained, have wireless masts fore and aft of the conning tower, instead of centered as in this illustration*

The larger submarines, denominated as fleet submarines, of the Lake type, are high speed craft, considered valuable as commerce destroyers and for carrying on offensive warfare. This type of vessel is designed to carry torpedoes firing in line with the axis of the ship both fore and aft; it also carries torpedo tubes in the superstructure, which may be trained to fire to either broadside. These vessels are fitted with wireless and sound transmitting and detecting devices.

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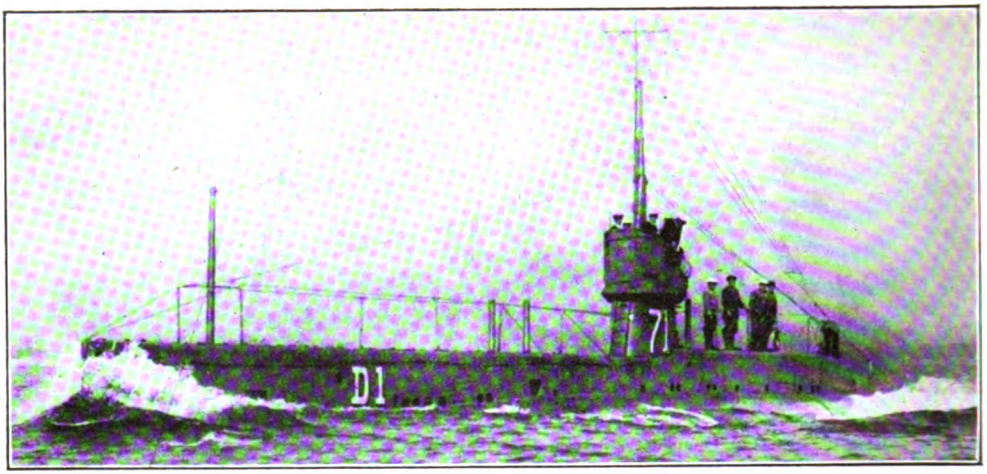


*The British submarine, a fine ocean going craft, wireless equipped with aerial strung fore and aft, pyramid fashion*

Electricity plays a part of growing importance in engines and apparatus designed for the conduct of warfare. Electrical apparatus of every conceivable kind is being utilized by the armies in the field and aboard the vessels of the navies of belligerents. The submarine more particularly has adopted innumerable electrical devices. It is a case where necessity is the mother of invention, since for its preservation when it dives beneath the water, the undersea craft depends upon storage batteries for power, light and heat, and when afloat, a further use of electrical energy is made in its application to the wireless equipment.

An English engineer, W. O. Horsnaill, recently gave an interesting description of the many applications to which electricity was put in the mechanisms of the undersea boat. The most important of all, he says, is naturally the application of electrical power for the propulsion of the vessel under water, when it is impossible to obtain the air needed for running the oil engines.

Many types of motors are installed in submarines, which are used for air-compressing, pumping, ventilating, heaving up the anchor, and other needs. All Cooking is done by electricity. In a 1,500-ton submarine no less than twelve electric motors are utilized, and this does not include the wireless equipment and the gyro-compass with which the under sea craft are now generally fitted. This exhaustive electrical equipment includes motor starters, switch gear and instruments.

In the design of wireless telegraph equipment for undersea craft, the widest diversity of invention appears in the antenna or aerial features. Aside from the mast-strung and balloon suspended wires already described, there are conducting surface deck plates, floats and collapsible towers of various kinds, some of which have been used experimentally and some not at all.

A portable and collapsible antenna which is now receiving favorable attention is the invention of an American, illustrated in the accompanying drawings. Fig. 1 shows an elevation of the antenna partly extended; 2 is an end view; 3 is an edge view, showing the antenna collapsed and ready for storage; 4 is an enlarged fragmentary detail showing the antenna partially collapsed; 5 is an enlarged detail in elevation.

The feature of this device is that the antenna may be of any desired length and, the wire being wound spirally, may be collapsed into small compass, as seen in Fig. 3. By attaching a rope to one of the insulators the antenna is quickly hauled up the mast or tower and put into immediate use. The members are formed of flexible but non-elastic material, such as oil silk.



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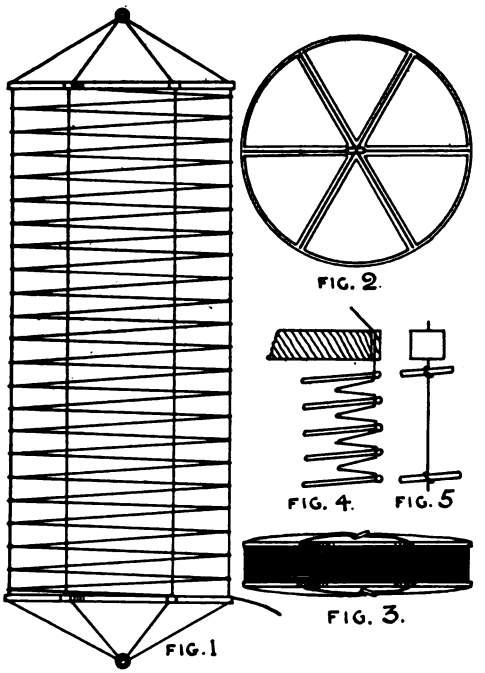



*A portable and collapsible antenna now receiving favorable attention*

In the design of apparatus suitable for submersibles, the Marconi Wireless Telegraph Company of America leads with a new type of radio apparatus, a ½ k.w. 500 cycle panel set, made especially for submarines, the power being measured at the transformer primary terminals. This new submarine panel set is of the noiseless quenched gap type, the objectionable feature of noise in the operation being eliminated. It has also the high pitched penetrating musical note which is produced by high frequency apparatus and can be read through static when low frequency notes are unreadable.

A detailed description of the equipment is as follows:

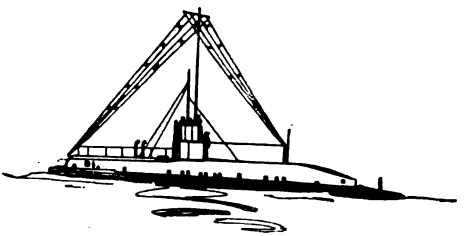
The set is a ½ k.w., 500 cycle, with quenched and rotary spark, and consists essentially of a complete transmitting apparatus and a complete receiving apparatus, together with the necessary accessories for operation and control.

The transmitter consists of a transmitting panel on which are mounted the measuring instruments, a variable inductance, a fixed inductance and a movable inductance, a spark gap and various switches and rheostats for controlling the wave-lengths and power emitted.

Two spark gaps are provided with the set. The quenched gap is mounted on the forefront of the transmitting panel. The rotary gap is mounted on the end of the motor generator. A switch is provided so that either gap can be used at will.

To operate the motor generator, an automatic starter is used in conjunction with a remote control switch. The latter can be installed at any convenient place readily accessible to the operator while on duty. If the noise from the motor generator interferes with his reception of signals, he can start and stop the machine from his table, thus eliminating the necessity of leaving his post to perform this duty. A dynamic brake is used in connection with this starter, so that when the current is shut off a resistance is connected across the motor terminals in such a manner that the machine is stopped in a comparatively short period of time.

The automatic starter mechanism and its appliances, together with a D.C. line switch, a generator field switch and an A.C. generator switch, is mounted on a panel just below the main transmitting panel. Marked terminals are provided for all wires



*Detail view of aerial construction on the British submarine shown on the preceding page*

running from this board to other apparatus. The motor generator is mounted on a framework platform in the rear of the control panel, and the starting and stopping resistance is bolted on just beneath it. The starting and stopping resistance is contained in a separate sheet steel box, and is connected to the control panel by lead covered wires grouped together and called "Resistance Group."

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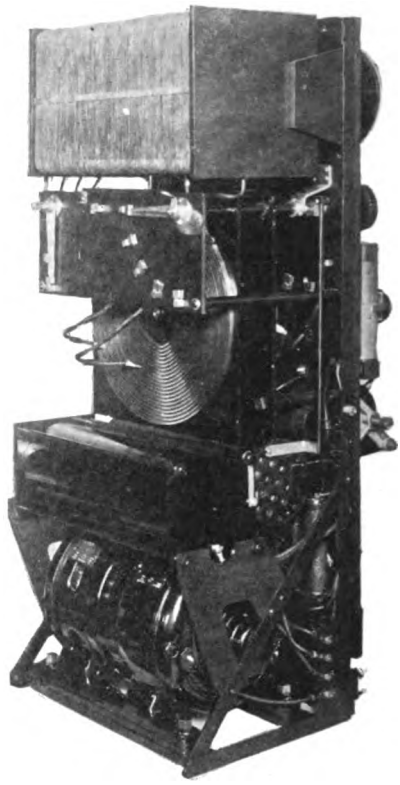
The motor generator consists of a 110 volt direct current motor directly connected to a 120 volt, 500 cycle A.C. generator. The motor is so connected that it will operate on voltages varying from 95 to 115 volts with very little variation of speed from a normal speed of 2,500 R.P.M. A field rheostat is mounted on the transmitter panel for regulating the speed of the motor within narrow limits.

The generator is of the inductor type and has a normal open circuit voltage of approximately 350 volts and a working or load voltage of 120 volts. The voltage can be varied by means of a rheostat, which is mounted on the transmitting panel. The rheostat is in series with the generator field and permits varying the current through the field, which is excited from the D.C. line.

Six protective condensers are provided for the purpose of protecting the motor generator and transformer from excessive potentials, caused by the operation of the transmitting apparatus. These condensers each have one of their terminals connected together, and to the frame of the machine, the frame being connected to the ground. The other terminal of each condenser is connected to a terminal of the motor generator in such a manner that each terminal of the motor generator is connected to the ground through its respective condensers. The motor generator is connected to the control panel by means of lead covered wires in two groups, viz., "Motor Group" and "Generator Group." The lead covering of these wires is connected together and grounded to the machine frame and panel frame. The six protective condensers are mounted on and in the rear of the control panel.

The transformer is of the closed core type and is immersed in non-liquid oil. The primary is connected to the control panel by means of lead covered wires, which have their covering grounded to the transformer case and to the panel frame. The secondary of the transformer is brought out through two insulators on which the terminals are



*Rear view of the Marconi submarine set, mounted on a single panel and generating ½ k.w. power*

mounted. A protective gap is provided which permits a discharge to take place when the potential becomes excessive. The secondary terminals of this transmitter are connected to the terminals of the high potential condenser of the transmitting circuit. The elements of the transmitting circuits, with the exception of the spark gap, are all mounted on insulators back of the transmitting panel, and in such a manner that all changes or adjustments can be made by means of handles on the front of the panel.

The transmitting circuit consists of a closed oscillating circuit and an open or radiating circuit, known as the "aerial circuit." These two circuits are inductively coupled. This coupling can be varied by means of a handle (marked "coupling") mounted on the front of the panel. The transmitting panels are so constructed that three different wave-lengths can be trans-

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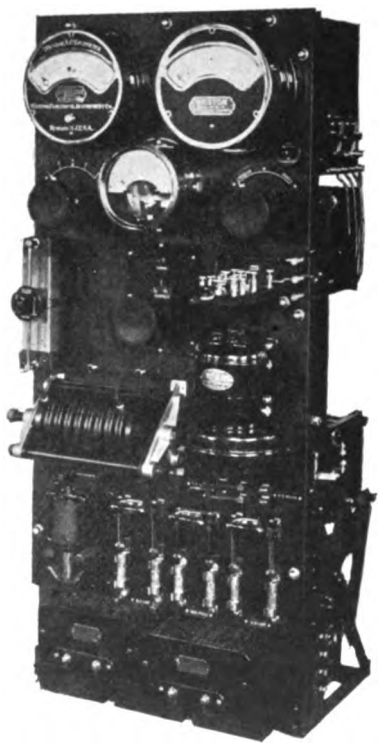
mitted, viz.: 300 meters, 450 meters and 600 meters. The capacity in the closed oscillating circuit consists of a high potential condenser, the total capacity of which is .004 m.f. This condenser consists of four Leyden jars mounted on insulating supports, just below the top and in the rear of the transmitting panel, so that they can be easily removed when replacement is desired. The change of wave-length is made by varying the amount of inductance in the closed oscillating circuit. A switch handle marked "Wave-length" adjusts the closed circuit and at the same time indicates on the scale the wave-length setting.

The condenser jaws are calibrated for a capacity of .001 microfarad each. The amount of inductance in the closed circuit is fixed permanently at the factory and requires no further adjustment. The coupling between it and the aerial circuit is varied by moving the secondary coil in and out by means of a handle marked "Coupling."

The open or aerial circuit consists of a secondary inductance, loading inductance and aerial tuning inductance. These are all connected in series. The secondary inductance is movable relative to the panel. The loading inductance is variable by any desired amount by means of contact clips; and the aerial inductance is variable by means of a handle marked "Aerial Inductance." The outer end of the secondary inductance is connected to the earth through the thermo element of the radiation ammeter. Taps are taken of this inductance, at the necessary points, which, in turn, are connected to a switch controlled by a handle which varies the wave-length. This switch is for the purpose of varying the wave-length of the aerial circuit, and is called "Wave-Length Switch."

Another set of contacts is provided which connects with points on the loading coil of the aerial inductance. The inner terminal of this inductance is connected to the movable arm of the variable inductance. The outer terminal of the variable inductance is connected to the aerial circuit through the antenna switch. The object of these connections on the wave-length switch is to provide means for varying the amount of inductance in the aerial circuit, and at the same time maintain the necessary coupling between the primary and secondary circuit, without varying the distance between the two inductances. This permits changing the wave-length by throwing a single lever. A "Lightning Switch" serves to ground the aerial during atmospheric disturbances.

A change-over switch is provided in



*Front view of the ½ k.w. 500 cycle panel set, designed by the American Marconi Company's engineers for submarines*

the closed oscillating or primary circuit, which permits either the quenched gap or the rotary gap to be used at will. When the switch is thrown in position for using the rotary gap it is necessary to short-circuit the quenched gap. This is done by means of the clips which are connected to the same plate.

The receiver consists of a type 106 tuner and crystal detectors. This receiver consists of a primary circuit which

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has its inductance variable. One end of this inductance is connected to the antenna through the type S. H. switch. The other end of the inductance is connected to the ground through a variable condenser which can be short-circuited or inserted in the circuit at will. The secondary circuit is so constructed that its inductance can be varied, and also its inductive relation with the primary circuit can be varied. A variable condenser is provided which permits a variation of wave-length and also the variation of the ratio of capacity and inductance while maintaining the same wave-length. A battery and potentiometer are provided which permit controlling the current through the detector. A pair of head telephones is used for receiving the signals, while a buzzer is provided which permits the local excitation of this receiver so as to determine its condition of sensitiveness; also a battery which furnishes current for both the detector and the buzzer.

A type S. H. antenna switch is provided which, when in sending position, protects the receiving circuits from being excited by the transmitter, and when in receiving position cuts out the transmitter and connects in the receiver for reception. This antenna switch also has three auxiliary contacts which start and stop the motor, open the A. C. field, preventing disturbance from the generator, and also open the transformer primary circuit, so that signals cannot be transmitted while the switch is in receiving position. A single pole flush switch called the control switch is provided which, when closed, keeps the motor generator runninng continuously. This switch can be kept closed when the noise from the motor generator does not interfere with the reception of signals. When this switch is open the motor generator will start and stop as the switch is thrown from transmitting to receiving position.

A key is connected in series with the primary of the transformer. A series condenser is inserted in the aerial circuit between the aerial inductance and the type S. H. antenna switch, the object of which is to shorten the wave-length of the aerial for the operation on the 300 meter wave-length. If the natural period of the aerial is below 250 meters this condenser is not needed. It is short-circuited on other wave-lengths, viz.: 450 and 600 meters.

The radiation meter furnished with these sets is of the thermo type and consists of a wire heated by the aerial current which, in turn, heats a thermo junction, which latter operates a direct current instrument. The heating wire is connected in series in the aerial circuit and the indicating ammeter is connected to the thermo-junction by means of lead covered wires, the coverings of which are grounded.

A wattmeter indicates the power consumed in the transformer circuit. The current coil of this instrument is connected in series with the transformer primary and the potential coil is connected across the terminals of the transformer primary. This meter, therefore, indicates the power being consumed in the primary of the transformer.

To meet the Government requirements, provision is made for transmitting at a low power. This is accomplished by throwing a fixed resistance in series with the field, which, in turn, reduces the potential of the generator. In order to achieve this end, a switch marked "low power" is opened, at the same time connecting in one gap only of the quenched gap. This low power condition cannot be obtained when using the rotary gap.

The foregoing is a general description of the apparatus, and its object is to give a general idea of its type and functions.

The previous descriptions of the uses and utilities of wireless equipped submarines may have given a faint conception of the value to undersea craft of their radio installation. But what the radio set really means in all its bearings to the boat that floats under and over sea is known probably only to the commander and his operator. It represents the ears and even the eyes of the craft, the guardian that preserves it from danger, and the herald that announces the approach or proximity of its enemy. Through it, the undersea fighter has doubled in efficiency, the proof of which is contained in the daily news of raids and escapes directed by the unseen hand at a crackling key on shore.

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# How to Conduct a Radio Club

*(Especially Prepared for the National Amateur Wireless Association.)*

## Receiving Detectors for Wireless Telegraphy

**By Elmer E. Bucher**

**ARTICLE XXIV**

THE members of a newly formed radio club frequently do not fully understand the properties, functioning, relative sensibility or the general instruction for the working of the various types of receiving detectors in use today. Hence they are not able to easily decide on the type of receiving detector best suited for the local requirements. For beginners in this class, there follows a description of the more important types of receiving detectors, together with additional advice for adjustment and operation.

*Electrolytic Detector.*—A receiving detector that has rapidly fallen into disuse since the discovery of the sensitive crystals is the "whisker point" electrolytic responder, although in the early days of wireless telegraphy in the United States it played an important part. The essential elements of this detector are indicated in Fig. 1 and the correct circuit for its operation in connection with an inductively coupled receiving tuner, in Fig. 2.

Referring to Fig. 1: The upright binding post, M, has the extended arm, R, through which is screwed rod A. The latter has soldered to the lower end a piece of platinum wire, W, having a diameter varying between .0001 and .000038 of an inch. This wire is known as "Wollaston wire" and was formerly used for another purpose. It is coated with silver to permit easy handling.

The fine platinum point dips into the glass cup, C, which need only be large enough to hold eight or ten drops of a 20 per cent. solution of nitric acid—the electrolyte. In the base of the glass cup is placed a small sheet of platinum, E, about 3-16 of an inch square, which is connected to the binding post, C, by means of a connecting wire placed under the hard rubber base.

*Circuits for the Electrolytic Detector*—The preferred circuit for this detector is indicated in Fig. 2, the important part of the diagram being the connection of the potentiometer and the local battery. The battery, B, should be one of five or six volts shunted by a wire wound potentiometer, P-2, of 300 to 400 ohms resistance. The telephones, P-1, may vary from seventy-five ohms to 2,000 ohms, the point of importance here being that they are well constructed and sensitive. The positive pole of the battery, B, should be connected to the fine wire point of the detector. The variable condenser, C-2, should have at least a maximum value of .0025 microfarad.

*Operation*—To adjust this detector to a sensitive condition, two rules must be observed. First, the fine wire platinum electrode must just touch the acid, in fact barely make contact with it; second, the silver must be removed from the platinum wire.

The silver coating may be removed by three methods: First, an abnormal value of battery current from the local battery, B, may be sent through the electrolyte with the platinum point slightly submerged. A hissing, grumbling sound is heard which, after a period of two or three minutes, tends to cease. The current from the local battery, B, is then reduced until a buz-



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zer tester indicates a loud response. The second method is to remove the fine wire electrode from the holder and place it for a moment in a very strong solution of chemically pure hydrochloric acid, the point being removed at intervals and examined by the aid of a magnifying glass to determine the degree to which it has been "trimmed." If an extremely fine "whisker" is observed, the point is ready for use and to prevent further action of the hydrochloric acid, it should be dipped in fresh water. The third method is to heat a small amount of mercury over a Bunsen burner. If the platinum point is dipped into the hot mercury, the silver is immediately removed.

The support for the holder of the fine point, W, is preferably of another design, in fact the holding rod, A, had better be a square one entering the arm, R, through a square hole. The rod, A, is then moved in a vertical position by means of a rack and pinion. Since this design demands rather elaborate construction, the holder, shown in Fig. 1, is considered sufficient for amateur requirements, but it is of advantage to have a holder that prevents the platinum point from rotating during adjustment.

The amount of acid in the containing cup and the area of the surface of the lower electrode of the cell are unimportant with the exception that the upper point and the lower electrode should be separated by a distance of no more than ¼ of an inch.

It was the custom at commercial stations for a number of years to employ glass coated electrodes. The small platinum wire was sealed in a glass jacket with only the extreme tip exposed, and since the remainder of the wire was covered with glass, the depth to which the platinum electrode was lowered in the solution had no effect on the degree of sensibility obtained. The process of sealing the fine platinum wire in the glass is a little difficult for the experimenter inexperienced in glass-blowing, but one familiar with work of this nature should meet with no difficulty in constructing an electrolytic point of this type.

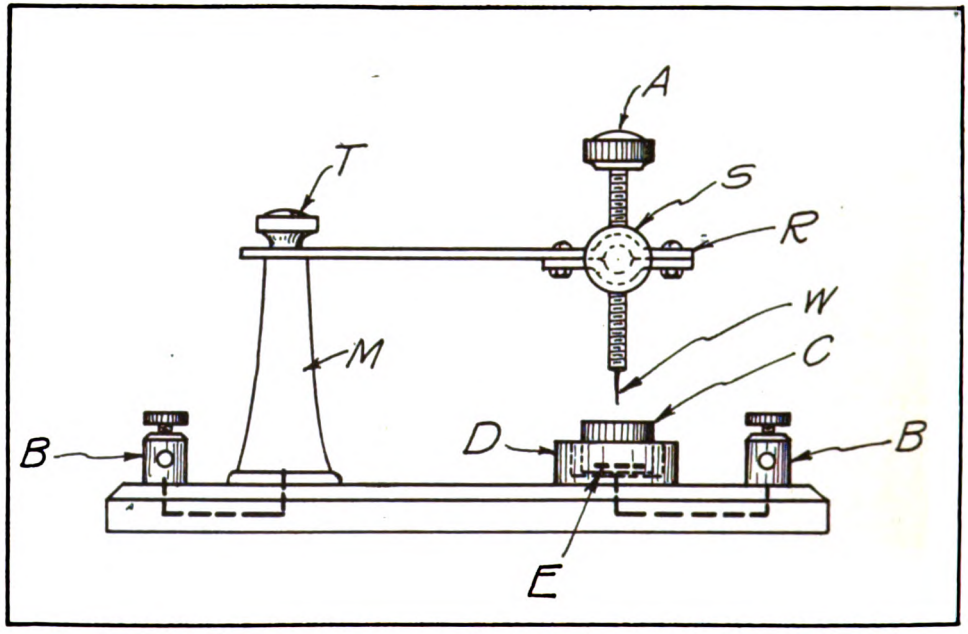


*Fig. 1*

Good results have been secured with the electrolytic detector by the use of a super-saturated solution of caustic potash, but the acid solution is more generally favored.

Several theories have been advanced regarding the action of the electrolytic detector; the subject is still a

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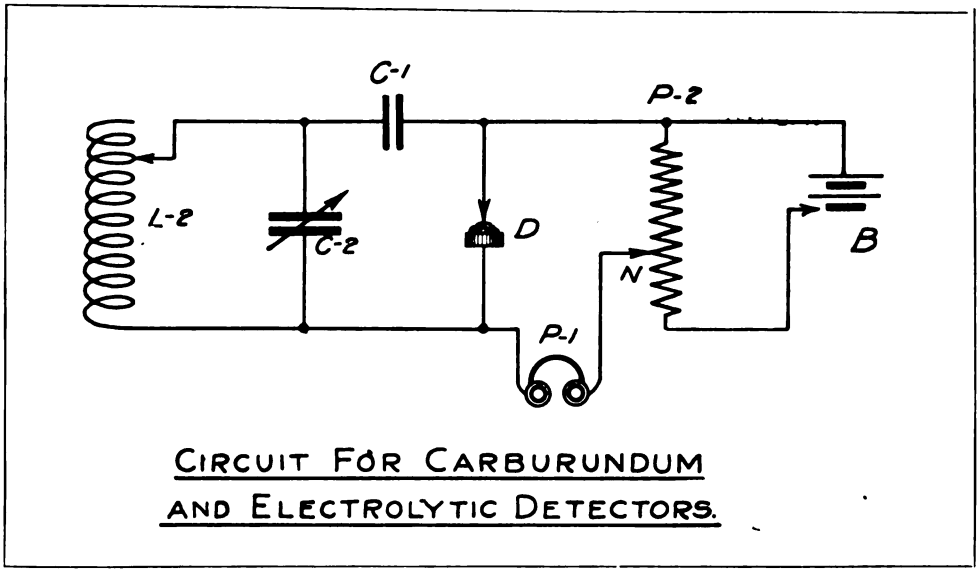


*Fig. 2*

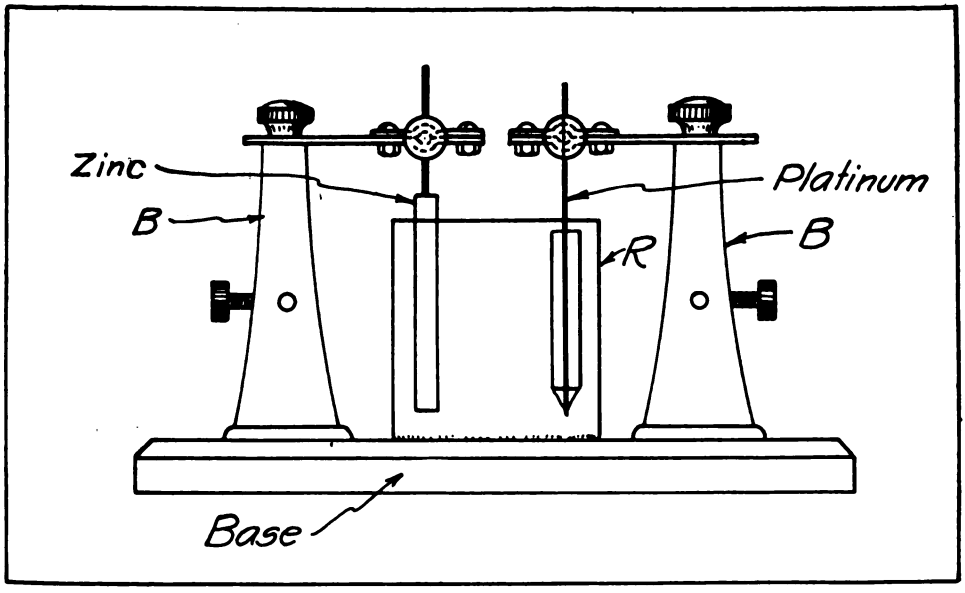


*Fig. 3*

matter of argument, but it seems to be the general opinion that the energy picked up by the antenna wires, which is transferred to the local circuit, causes a variation of the current from the local battery which, of course, results in the production of a note in the head telephones. For further discussion of the operation of this detector the reader is referred to some of the more important text books on wireless telegraphy.

It may be of interest to some experimenters to know that signals from the electrolytic detector can be amplified by means of a single vacuum valve. (See the book "How to Conduct a Radio Club.")

*Primary Cell Detector*—Another form of electrolytic detector, sensitive and reliable in operation, is known as the primary cell detector or the "Shoemaker Electrolytic." In addition to performing the function of a detector,

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it has the added property of generating its own battery current; in fact, it is nothing more than a small chemical battery constructed so it can be adopted for use as a wireless telegraph receiving detector.

The details of the device appear in Fig. 3. To a hard rubber base are fitted two upright binding posts, B, and the hard rubber or glass cup, R, having a capacity of about four or six ounces of electrolyte. The left hand element of the cell is a small piece of amalgamated zinc about one-third the size of that usually employed in dry cells. The right hand element is a small platinum electrode having a diameter of .001 or .0001 of an inch, sealed in glass, with the tip of the wire only exposed to the acid. The electrolyte is a twenty per cent. solution of sulphuric acid in which the two elements are immersed. If a telephone is joined across the two terminals of the primary cell a decided click is heard, indicating that an electric current is being generated. In fact, such cells have often shown an electro-motive force of 0.5 volt.

*Circuit for the Primary Cell*—The correct circuit for the primary cell detector appears in Fig. 4. The telephones, P-1, are joined across the terminals of the primary cell and may have a resistance of 1,000 to 2,000 ohms. The condenser, C-3, should be variable in capacity and possess a maximum value of .005 microfarad. Good results can frequently be obtained by connecting the head telephones in shunt to the condenser, C-3. Owing to the simplicity of this detector, preliminary instructions are not required. It is only necessary to insert the elements

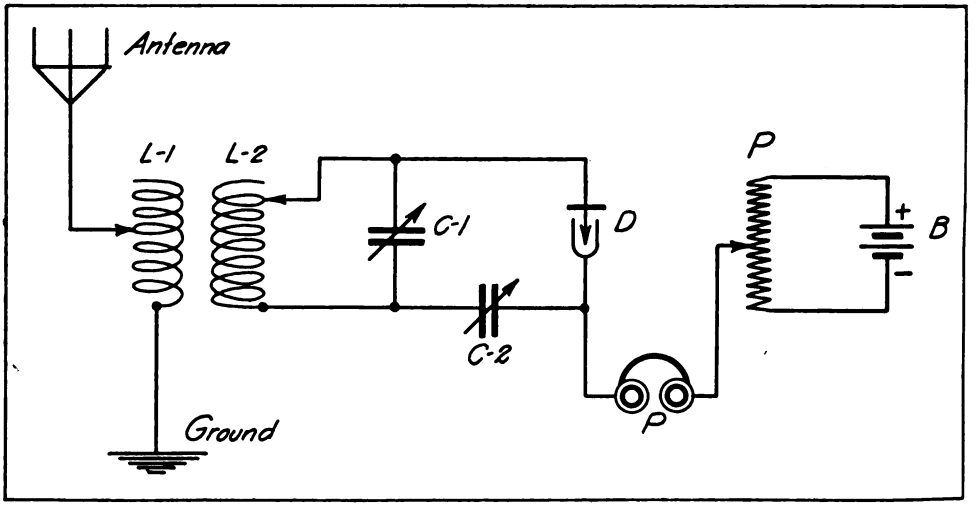


*Fig. 4*

in the acid and carefully adjust the tuning elements of the receiving tuner until response from a given station is obtained. The only difficulty experienced with the detector is the fact that the platinum point will polarize rather rapidly which has the effect of reducing the sensitiveness. The accumulation of gas upon this electrode can, however, be destroyed by shaking the point, or the action is automatically performed by a severe discharge of atmospheric electricity at any given station. Occasionally it is necessary to remove the zinc electrode from the solution for a thorough cleaning, after which it should be coated with amalgam of mercury.

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A bare electrode of the type used in the "whisker point" electrolytic may also be employed for the primary cell, but, of course, the depth to which the electrode is immersed in the solution must be very carefully gauged. Experiment seems to prove that both of these receiving detectors require a secondary winding of rather low resistance, hence a receiving tuner employing No. 24 or No. 26 S. S. C. wire for the secondary winding may give the best results.

Both types of detectors are sensitive, particularly the "whisker point" electrolytic, which, when properly adjusted, compares very well with the sensitive type of mineral detectors. It is, however, not so rugged as crystals of carborundum and possesses the added disadvantage that severe discharges of atmospheric electricity burn off the fine wire point, putting the detector completely out of operation until a new point is prepared.

*(To be continued)*

EDITOR'S NOTE.—In the July issue of this magazine the author will continue the description of modern receiving detectors together with the details of the circuit best adapted for use with each. It is expected that beginners in the amateur field unable to obtain complete data on the subject will welcome the information given therein.

## THE MACQUARIE ISLAND STATION CLOSED

The wireless station at Macquarie Island, located south of New Zealand, has been closed. Employed largely as a distribution point for meteorological reports, the station had a greater value than is generally known. New Zealand was approximately 600 miles distant from Macquarie Island and it took about one and a half days for a storm approaching from the island to reach the dominion. Therefore the Macquarie station was enabled to give New Zealand at least thirty-six hours' warning. Similar conditions applied to Australia. Melbourne, 1,200 miles away, received word of approaching storms three days before they reached the Australian coast.

The meteorological information obtained on Macquarie was also of considerable value in connection with the weather conditions of the world as a whole and for research work. The locality of Macquarie, it is said, has never been charted meteorologically. The anemometer recorded on one occasion a blow of seventy-six miles an hour.

The station is 4,000 feet above the sea level and, in order to avoid the ascent of the hill in stormy weather, F. J. Henderson, the operator, constructed a small receiving station at Eastern Harbor. The Macquerie station was frequently in communication with Awanui, Auckland, 1,500 miles away.

## 5,073 STATIONS IN THE U. S.

The Bureau of Navigation, Department of Commerce, has issued the 1915 edition of "Radio Stations of the United States." This list shows that there are now 5,073 wireless stations in the United States, an increase of 1,139 since 1914. They are classified as follows: Government and commercial land stations, 224; government and commercial ship stations, 895; special land stations, 118; general and restricted amateur stations, 3,836.

## ILLINOIS MILITIA TEST SETS

To test the efficiency of its portable wireless telegraph instruments and to conduct experiments with its wireless field telephone, the headquarters detail of the Second Battalion, Field Artillery, Illinois National Guard, recently went on a two-day hike from Chicago to Willow Springs and back. The detail consisted of twenty-eight men, mounts, two wagons to carry instruments and wagons of the commissary department.

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# With the Amateurs

One evening recently the atmosphere over Indianapolis, Ind., was unusually crowded with wireless signals. It seemed that almost every one of the seventy-five local amateurs with sending outfits licensed by the government, was bent on saying something to somebody. Much of this, as is the case on any evening, was inconsequential, although it was dashed off in good style at a speed and with abbreviations, standard and improvised, that would make a good operator keep busy copying.

On this same evening the local militia companies were demonstrating their preparedness to visitors at the armory. Included in the program was the operation of a field wireless set. Some time after nine o'clock all local operators who were listening in began to hear this field set, easily recognized by its strange, high, wailing note. The militiaman in charge made several attempts to get in touch with local stations, which he evidently heard working. That he found all too "hot" for him was plain when he finally let out the following despairing cry through the ether, a confession not so much of unpreparedness, perhaps, as of nervousness under fire:

"I am demonstrating this set for visitors. For the love of Pete send slower, as they have put me on this job and I don't know a thing about it.

"(Signed) COMPANY A."

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The Radio Club of Framingham has been recently formed at Framingham, Mass. The following officers were elected: President, Lawrence Potter; vice-president, Francis Twombly; secretary-treasurer, J. Louis Reynolds. Those interested in the club have been asked to communicate with the secretary at No. 20 Gordon street, Framingham, Mass.

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The St. Paul's Amateur Radio Association, of Rochester, N. Y., is about to install at its headquarters one of the largest and most complete amateur wireless sets in the western part of New York state. The set that has been in use since the organization of the association will, in the future, be used for experimental purposes only. A new seven-strand phosphor-bronze aerial will be erected for the apparatus.

It is planned to have many residents of the city who have a knowledge of wireless telegraphy give lectures at the meetings of the association. It now has a membership of twenty-two persons, of whom nine hold licenses issued by the United States radio inspector at Cleveland.

The meetings of the association are held Friday evenings at St. Paul's Annex, No. 13 Vick Park B. Applications for membership should be made to E. Lewis Alexander, No. 34 Asbury street.

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More than thirty amateur wireless operators met on the evening of April 25, in the rooms of the Central Y. M. C. A., at Albany, N. Y. Plans were discussed to co-operate with the U. A. Army in the event of war, and arrangements were made for a permanent organization. There are forty stations in Albany and about one hundred all told in the vicinity. It is planned to erect a powerful station at the Central Y. M. C. A., which will be the headquarters of the new organization.

Several of the amateurs operate powerful apparatus. J. Kenneth Hewitt, of No. 92 Willet street has an apparatus on the car house of the United Traction Company in Quail street which is capable of receiving a distance of 1,200 miles or more.

The club expects to affiliate with the National Amateur Wireless Association.

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Larger and more convenient quarters for the Central Y. M. C. A. Radio Club,



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of Trenton, N. J., are being arranged in the Y. M. C. A. building. The apparatus will be taken from the third floor and installed in the older boys' reading room on the second floor, which is directly below the aerial.

This change will enable those who are not members of the club to see the work being done, and will also give the members a better chance to operate the wireless. At the present time the equipment is located in dormitories and certain times are set aside for its use.

At a recent meeting of the organization, John Pritchard was elected president. He is now engaged in installing a rotary spark gap.

Under the new arrangements there will be a bench on which there will be sufficient space for four phones, enabling four members to listen in and receive messages at the same time.

Following the regular weekly meetings each Wednesday evening, experiments are conducted, during which time each member makes an effort to improve his ability as an operator.

This feature is in the form of a contest, and the one showing the greatest increase in speed at the end of the month receives a prize.

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A meeting of the Amateur Marconi Radio Association, of Troy, N. Y., was held on the evening of April 15, at the Y. M. C. A. Receiving practice in the wireless code was resumed. Plans were made for the installation of a high-power station in the Y. M. C. A. building. The matter of holding an exhibition in wireless during the Troy centennial celebration was discussed and several interesting pictures were shown by means of a projecting machine. Thomas Halloran of the United Traction Company spoke on "Transformers."

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The Flatbush Signal Corps attached to St. Stephen's Evangelical Lutheran Church, Newkirk avenue and East Twenty-eighth street, Brooklyn, N. Y., has recently become affiliated with the National Amateur Wireless Association, whose membership comprises practically all of the government licensed amateur wireless operators in this country. Captain G. H. Smith, commanding officer, has been made a member of the military committee of the association, some of the other members of the committee comprising radio officers of the U. S. Army and Navy and others prominent in wireless work. Lawrence Barriett has been detailed by the National Amateur Wireless Association to take charge of the electrical work of the corps.

The corps has seventy-three members now and three platoons have been organized, with Lieutenant Barriett in command of the Third, or Electrical Platoon, which will include a complete radio set with a high-power apparatus and a field buzzer section, with full equipment to maintain actual lines of communication in the field.

A few weeks ago, the corps gave an exhibition drill of semaphore, buzzer, wig-wag and radio, in the Forty-seventh Regiment Armory.

The corps expects that a number of its members will take the Government wireless examinations soon. More than thirty recruits have joined the organization recently.

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The Wireless Club of the Bayonne, N. J., High School met on April 3, and discussed recent wireless activities.

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The Holyoke Radio Club has been organized in Holyoke, Mass., with fourteen members. At future meetings a blackboard lecture will be given by one of the members and these lectures will deal with the vital points in the art such as the principles, construction and care of simple wireless instruments. Practice of the Continental code will also be an integral part of each meeting.

Correspondence is solicited from those who are interested. Letters should be addressed to P. H. Bloom, No. 9 Adams street, who is secretary of the club.

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Members of the Watertown, N. Y., Radio Association who are checker enthusiasts took part recently in nightly long-distance games of checkers. This odd diversion has a number of devotees, and plans are now being made for a general tournament in which the entire per-

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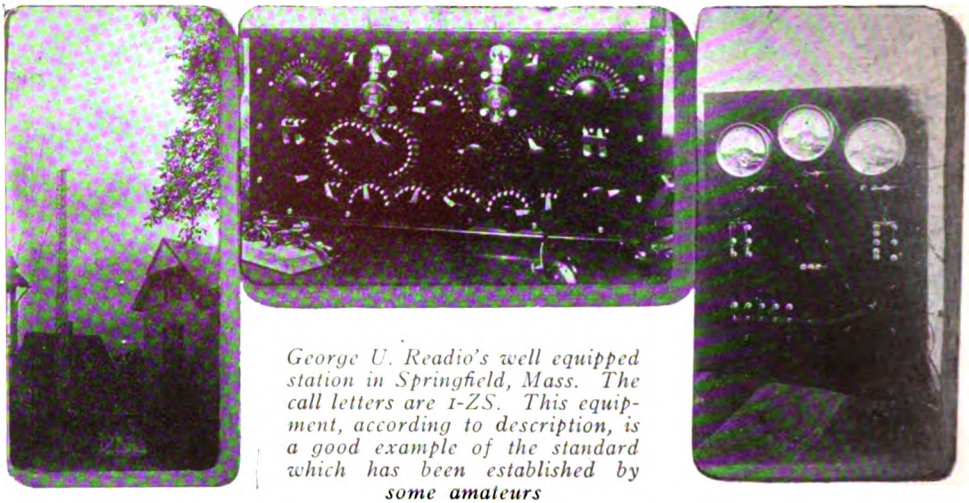

*George U. Readio's well equipped station in Springfield, Mass. The call letters are 1-ZS. This equipment, according to description, is a good example of the standard which has been established by some amateurs*

sonnel of the organization will participate.

In playing checkers by wireless, two boards, instead of only one, are used. The squares on these are numbered, while each set of men is lettered. By this system the various moves are easily designated and the game pursued without delays. Three hours were consumed in playing the first game some time ago. Now, however, it requires only a little more time to play off a wireless game than one contested in the usual way.

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A good sized audience greeted Charles E. Apgar at the High School, at Westfield, N. Y., when Mr. Apgar repeated the lecture which he recently gave. He had added a number of experiments to those previously shown. Following the lecture Mr. Apgar presented to the school the greater part of the apparatus used.

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The second class in wireless telegraphy met in the Gloversville, N. Y., Y. M. C. A., on April 19, and received instructions and code practice from Grant Patterson and Richard Sanford. The following have enrolled as members: Grant Patterson, Leonard Edick, Richard Sanford, Raymond Brown, Louis Cregg, Jay Enich, Leslie Frye, Samuel Morein, Leslie Satterlee, Maurice Sandler and Tony Rossi.

Though there are a large number of amateur wireless telegraph stations in Massachusetts, Foxboro is distinctive in having a wireless plant on and in a church parsonage. The pastor of the Congregational Church is the Rev. W. Elsworth Lawson, author and lecturer, as well as minister. His son, Elsworth Lawson, is responsible for the supports, aerials and wires that have been erected on the minister's home. One of the aerial supports rises in the shape of a 14-foot joist from the high ridgepole of the parsonage room, near the front; the wires are strung over the building to another support on the barn adjoining.

One room has been set apart in the second story of the parsonage for the operator's apparatus. Every night he receives weather predictions and time from Arlington, and picks up many messages sent from other stations.

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Many members attended the last meeting of the Washington Radio Association of Trenton, N. J., at the headquarters in the Washington Market Building. Following a short business session, Edward Knowles read a paper on "The Correct Operation of the Loose Coupler Tuner." He made a thorough explanation of the proper adjustment and advantages of the loose-coupler. Amery Parichy talked interestingly on aerials, grounds and



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some freak experiences. Frank Silvers told of the various apparatus used in the United States Naval Radio Service. President Martin Pillsbury spoke of the Brooklyn Navy Yard Radio School and explained a receiving ticker by showing the instrument in operation. Following these talks the members practiced receiving and sending on the apparatus in the club room. Every member is now licensed; half of the members have second-grade operators' licenses and one has a first-grade commercial license; the other members have first-grade licenses for amateurs. A blackboard has been placed in the club room with which to explain diagrams.

Meetings are held every Monday and Thursday evenings.

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The Minnesota Wireless Association, formerly the Minneapolis Wireless Club, recently offered to transmit messages by amateur relay for experimental purposes. As a result messages poured in addressed to China, most of the United States and various parts of Mexico. Messages received up to April 10 were sent, but the club then decided to withdraw its offer.

Most of the messages contained greetings. Seattle, Tacoma, and other cities were reached successfully, demonstrating that the amateur wireless system of the country could be used in an emergency.

The "Wireless Bugs' Union" was organized at a meeting of the association held on the evening of April 7 to inject "pep" into the association's membership campaign. Its first work will be to organize all amateur wireless operators in Minnesota and provide them with code calls. A code book is being prepared.

A meeting of the association was conducted by wireless on April 3. Claude Sweeney, president, is radio operator for the International Milling Company at New Prague, Minn. He presided at the Minneapolis meeting.

Dots and dashes told Sweeney that motions were being made and seconded in Minneapolis. He responded in his official capacity by wireless. Paul Johnson, chief operator, received Sweeney's signals.

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George Pope of the Greenpoint Radio School, of Greenpoint, L. I., has offered his services to organize and recruit a signal and radio corps for the Fifth Regiment, United States Boy Scouts. He will instruct members in signaling and wireless.

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C. C. Langevin addressed the members of the Radio Club of Hartford, Conn., recently in the rooms of the Automobile Club of Hartford. Besides relating incidents on the peace ship Oscar II, Mr. Langevin described other voyages. One of the most eventful of these was the trip to Stockholm last November of the Standard Oil tankship Baturia. In addition to exceedingly rough weather, the voyage was marked by several incidents of interest. The climax of the trip was reached when a British cruiser brought the vessel into Kirkwall, where it was detained for three days before it was allowed to proceed across the North Sea to Stockholm.

At the meeting of the club it was announced that a first class wave-meter had been bought, and that Theodore Newhouse would devote two hours a week to helping members of the club tune up their wireless sets to 200 meters, in accordance with the requirements of the United States government for amateur stations.

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For the purpose of organizing a state radio association, the wireless operators of North Dakota met in convention at the State University at Grand Forks, on April 21 and 22. Thirty-nine stations, representing twenty-two cities of the state were represented.

The matter of meeting government requirements has been taken up by many stations and a large percentage of operators in attendance at the convention were able to present government licenses. The convention was called by R. T. Jacobson, Fargo; C. D.

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Curtis, Pembina; A. L. Smith, Fargo; P. H. Teal, Devils Lake; Dr. A. H. Taylor, Grand Forks, and M. E. Todd, Wahpeton.

Fargo leads in the number of radio stations, having ten; Grand Forks has six and other towns having stations are Aneta, Bismarck, Carrington, Devils Lake, Edgeley, Harvey, Havana, Hatton, Hope, Jamestown, Kathryn, Mandan, Mayville, Minot, Pembina, Russell, Tioga, Wahpeton, Washburn and Williston.

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The first class in radio telegraphy recently met at the Y. M. C. A., in Gloversville, N. Y., and received instructions from members of the Gloversville Wireless Association.

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The Inter City Radio Association of Allentown, Pa., held a meeting in the Y. M. C. A. on April 11. Several new members were admitted. In the absence of the regular presiding officer, the secretary, William J. Kreis, acted in his place.

At the present time the association has eleven active members, about half of whom hold licenses to operate wireless outfits. A movement is now on foot to enlist all those in the vicinity who are interested in wireless. All interested should communicate with D. H. Goodling, at the Y. M. C. A., any Monday after fifteen minutes after eight o'clock in the evening.

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The Radio Club of New Britain, Conn., held its weekly meeting in the Y. M. C. A. on April 11. President Mulvihill presided. The club has displayed much interest in the theory of sound, and Mr. Yuon, who has been investigating the subject, made a report of his findings.

The club has been looking over a list of lectures on wireless subjects, and has arranged to have Clarence D. Tusku of Hartford appear before it in the near future.

All of the committees reported progress in their work, the committee on publishing the club's book stating that

*Station of J. Weiss, Port Washington, N. Y., an excellent type of a high-grade amateur equipment*

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the publication will go to press soon.

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Elwood Littlefield, who has an amateur wireless telephone station in his home, at Sheepshead Bay, Long Island, recently picked up a call that he believes came from Montauk Point, according to a newspaper.

"Want to hear something on the graphophone?" queried a man's voice.

Some station, being without a wireless telephone transmitter, replied in the telegraph code. The answer must have been in the affirmative, for presently the air was filled with "Tipperary." At the conclusion of the concert warm thanks—in code—were projected from half a dozen stations that had been "listening in."

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Under the direction of the Radio Club of Rochester, N. Y., a wireless outfit will be installed on the roof of the Y. M. C. A. building at Gibbs street and Grove Place. This was announced at a meeting held April 23, in the association building. The apparatus will be of 1 k.w. power.

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The Eastern District Young Men's Christian Association of New York City has organized, in connection with its wireless telegraph school, a new radio club, to be known as the Eastern District Marconi Club.

This club is a member of the National Amateur Wireless Association, and will enable many amateurs to make interesting experiments, carry on communication at stated intervals and aid radio service generally.

The long-distance receiving set, about to be installed, has taken messages from Nauen, Germany; Glace Bay, Nova Scotia; Key West, Florida, and other distant points.

E. E. Bucher, instructing engineer of the Marconi Wireless Telegraph Company of America, who is honorary president of the club, will explain and adjust the apparatus for the uniniated before or after regular class sessions, Monday and Thursday evenings.

Members of the Radio Club have invited other amateurs to join the organization. Henry Flack is vice-president of the club and Ralph Greenmann is secretary and treasurer. Additional information regarding the organization can be obtained by addressing the secretary at No. 158 Berkeley place, Brooklyn, N. Y.

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The members of the Pilgrim Boys' Club of Attleboro, Vt., which was organized and elected officers recently, have announced that they intend to begin immediately the work of collecting funds to purchase a wireless outfit.

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At a recent meeting of the Binghamton Progressive Radio Association of Binghamton, N. Y., the following officers were elected: President, William Simons; vice-president, Mr. Adams; secretary, LeGrand Bush; assistant secretary, A. Hollister; treasurer, Roland Beers; assistant treasurer, Mr. Cowperthwaite; sergeant-at-arms, Richard Bush.

Mr. Kingsbury, the former president, was elected honorary president and made a brief address.

The club has a large membership, owns its own clubhouse and is rapidly growing. It has experimented with several types of wireless apparatus and is now installing a high-grade radio set. Persons wishing to communicate with the club should address the secretary, LeGrand Bush, No. 255 Main street, Binghamton, N. Y.

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A convention of the amateur wireless operators of Snohomish county, Washington, was held recently at Harvey Bancroft's station, No. 3024 Kromer avenue, Everett, when the Snohomish County Radio League was organized. The president of the new league is Kennil of Monroe; Harrington of Startup, is vice-president; Arthur B. Cook of Everett, secretary; Arthur Dailey of Everett, treasurer, and Harvey Bancroft of Everett, inspector. The purpose of the new organization is to bring about better communication among amateurs.

The club will meet the first Saturday evening of each month. The club hopes to include every amateur in the county in its membership. The char-

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ter membership list will be kept open for three months. All interested in wireless are invited to attend the next meeting of the club.

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A wireless apparatus has been set up in the high school at Poughkeepsie, N. Y., with aerials on the roof of the building. It is used by a class in physics, of which Carlton B. Olds is teacher.

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Wireless experimenters and amateurs throughout the South have organized for the purpose of offering their service to the United States government in the event of war. The men have formed an organization, which is know as the Fifth District Radio Club, because the South is known in the commercial radio field as the fifth district in the United States.

The members of the club are being trained in government requirements. They have at their disposal a modern equipment, including an aeroplane.

At the first meeting of this organization, held recently, Walter A. Taylor was elected president and C. Ashley Coe, secretary.

The headquarters of the club have been established in the instruction rooms and office of the school for the training of commercial operators, located in the Y. M. C. A. building, No. 815 St. Charles street, New Orleans, La. Warren C. Graham and T. George Deiler, instructors of this institution, have been made honorary members. The club is not connected with the training school.

Not only does the club contemplate assisting in the preparedness movement of this country, but it proposes to join organizations throughout the North and South and co-operate in the transmission of amateur messages across America. The newly formed club is described as the first of its kind to be organized in the South.

As soon as the club is placed on a permanent working basis, Secretary of the Navy Daniels will be called upon to accept the services of the club.

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The Radio Association of Maryland was organized in October, 1915, with the object of developing the less advanced members into licensed operators. Since its formation the membership has nearly tripled. The association is planning to buy a wave-meter and a hot wire ammeter.

Correspondence should be addressed to the secretary, Rudolf Dimling, Bancroft Park, Md. The association's call letter is 3ARK.

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The Radio Club of Rochester, N. Y., held its second meeting of the month at the Y. M. C. A. building on April 22. About forty members of the club were present, and several matters of interest to radio enthusiasts were discussed.

The club has extended an invitation to amateurs to attend its meetings. The object of the club is to instruct the future operators in such a manner that, if it should be found at any future time that the country is in need of radio men, they will be able to acquit themselves creditably.

The club is planning to install a 1 k.w. set of apparatus in its club rooms as soon as sufficient funds can be obtained.

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The Radio Club of Irvington, N. Y., which recently received its charter from the National Amateur Wireless Association, gave a benefit performance at the Liberty Theater in that village on May 2. A feature of the performance was a demonstration of wireless telegraphy made by the vice-president. By means of an amplifying arrangement attached to a panel set designed and built by Harry L. Dearborn of Lincoln, N. H, the audience heard the weather and time signals sent out by Arlington.

The club has received requests for another demonstration. The aerial—400 feet long and sixty-four feet high—which was erected especially for the event, will be left in position, the organization having planned to install a receiving set for baseball scores and weather reports to be flashed on the screen. The members of the club are preparing to produce a play that will require the use of a complete sending and receiving set.

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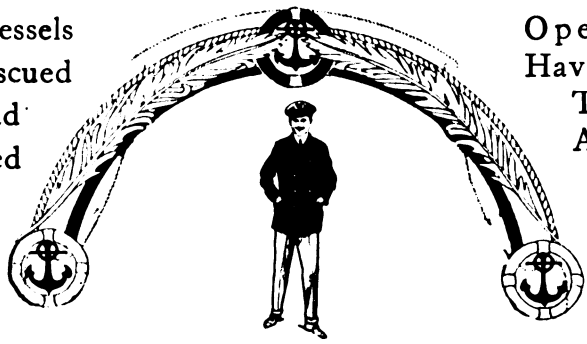
# How Wireless Has Served the Sea

**Part II**

Stories of Vessels That Were Rescued After They Had Been Wrecked on Rock and Shore



Operators Who Have Distinguished Themselves by Acts of Heroism in Time of Peril on the Ocean

"BIG White Star Liner Baltic Aground In Fog!"

One day, nine years ago, this alarming headline was paraded on the front pages of all the New York newspapers. The news of a great passenger vessel being aground in a busily frequented channel embraced all the potentialities of danger. For years such accidents had been sources of deep concern to those whose loved ones were aboard outbound or inbound ships. Mishaps of this nature so frequently had dangerous consequences.

But scarcely had the newspapers sent word of this happening broadcast on May 8, 1907, when all alarm for the safety of the vessel and its passengers was suddenly banished. The Marconi wireless message had sent its cheering note ashore, asking assistance for the distressed vessel, and giving the public assurance of the well-being of all on board.

The Baltic had left the foot of West Eleventh street, New York, bound for Liverpool, but two hours later she had gone aground while passing out of the Swash Channel. News of the grounding was at once received in the White Star Line offices, and passengers began to use the wireless to notify their friends that the vessel was fast in the mud and could not proceed, but that there was no need for worry since help was coming and safety was assured.

Captain Smith, the marine superintendent of the White Star Line, and several officials were already on their way on a tug to inspect the distressed vessel, and found her hard and fast on the shoals off Sandy Hook. The wrecking tug William E. Chapman was also proceeding to the Baltic, and soon the great passenger steamship was set afloat and steamed without further mishap to her port across the ocean.

Of all sea happenings, probably the most numerous are those in which vessels strike submerged rocks, or are stranded on the everchanging sands of narrows or treacherous bays and coasts. Here also, as in the case of fire at sea, or collision in midocean, or other casualties braved by floating ships, the Marconi system has stood the test with honor, the wireless never failing to bring aid to craft and crew and passengers. And the men of the Marconi service here also unhesitatingly face danger and death, living up to the fine unbroken tradition of efficiency that typifies the service.

It was only several months before the mishap to the Baltic that, at a foreign port, a like service was rendered to a distressed vessel, when the steamship Preston, on January 20, was stranded in similar fashion on Courtown Gays, St. Andrews Island, about 170 miles from Port Limon, Costa Rica. Assistance was summoned by wireless and all on board were rescued.



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An accident of like nature also happened to the steamship Seminole of the Clyde Line, on March 25, 1908, when she ran ashore at Point Pleasant, N. J., in a dense fog. The Clyde liner was in a more precarious position than the Baltic, however, for she began to pound heavily on the bottom, to the great alarm of the passengers. The distress call was sent out along the Jersey coast, speedily bringing wrecking tugs and life-saving crews to her assistance.

The United States revenue cutter Mohawk would probably have been pounded to pieces on the rocks of Hell Gate, on February 26, 1909, had not the appeals for help sent out by her wireless operator met with a prompt response. After having been buffeted by heavy gales and seas for six days, while searching for a derelict off Nantucket Shoals, the Mohawk, while on her way to Tompkinsville, struck on the Little Hogback, one of the rocks in Hell Gate off Ward's Island, and remained there leaking badly, her bow resting on two dangerous rocks, which threatened to tear a hole in her bottom with the fall of the tide. News of the accident was flashed to the Brooklyn Navy Yard by the wireless operator aboard the cutter a few minutes after the vessel struck. On behalf of Captain Landry, Commander of the Mohawk, he asked that the Navy Yard tug Powhatan and a transfer lighter be sent to the wreck as soon as possible. A second message was afterward sent to the Navy Yard for the Merritt-Chapman Company, requesting that two pontoons and a diver with a lighter be dispatches to the Mohawk without delay. A vessel situated as the Mohawk then was, could not possibly have summoned such varied and expert assistance in any other way than by wireless, which made her salvage possible.

The dense fogs that drift along the New England coasts are prolific sources of danger to coastwise steamships that creep their way through them, sounding their sirens. The steamer Massachusetts, owned by the New Haven Railroad and bound from Boston to New York, was suddenly in a precarious plight on the morning of March 11, 1909, when she grounded near Cedar Tree Neck, Vineyard Sound, Mass., while groping her way through the thick fog. She struck on the rocky bottom, and her forward compartments immediately sprung a bad leak. Her wireless operator quickly sent the calls for help to the Point Judith station, through which they were transmitted to Newport and New York. The revenue cutter Acushnet, stationed at Wood's Hole, went to the steamer's assistance shortly after dawn, and her passengers were safely transferred.

*Loren A. Lovejoy, whose quick wit facilitated the rescue of the Hanalei's people*

The quick summoning of aid by Stanley Coles, Marconi operator on the Cunarder Slavonia, on June 10, 1909, resulted in the rescuing of 410 lives, which would undoubtedly have been lost had it not been for the wireless message service. The Slavonia, then one of the crack carriers running from New York to the Mediterranean, went ashore on a reef off the southwest end of the Flores Island, one of the Azores group. The steamer Princess Irene, of the North German Lloyd, was 180 miles away when she picked up the

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*Men attached to the Bolinas sation helped victims of the Hanalei wreck to reach shore*

help call—C Q D. Her operator answered and immediately received a reply, stating that the Slavonia was ashore and where, and asking the Princess Irene to come to her assistance. Calls had in the meantime been heard also by the Hamburg-American Line steamship Batavia, and 300 passengers were transferred to her. The other passengers and the crew were saved before the Slavonia became a total wreck.

Then within a few weeks of each other, two vessels went ashore, one on the Atlantic and the other on the Pacific coasts, in each case both ships and cargo being saved by the summoning of aid by radio messages. On June 29 the steamer Mackinaw, of the Schubach-Hamilton Steamship Company, ran aground on the Yukon Flats. A wireless message to the steamship managers at St. Michael brought lighters to remove a portion of the cargo, after which the vessel was floated. On August 14 the steamer Helen, of the Atlantic Fruit Company, went ashore off Poplar Island, Chesapeake Bay, while heavily laden with a perishable cargo of bananas. The Helen was not equipped with wireless, but was sighted by the tug Savage, which at once sent out a distress call, bringing the necessary aid.

Less than two weeks later, on August 26, occurred off the coast of Alaska one of those ocean tragedies in which it falls to the lot of one man to sacrifice his life for the others who are dependent on his efforts for their rescue. The hero of this disaster was George C. Eccles, wireless operator, who stuck to his post in the radio room of the sinking ship until passengers and crew were assured of safety.

The steamer Ohio of the Alaska Steamship Company, while en route from Seattle, Wash., to Valdez, Alaska, via what is known as the inside passage, struck a rock at Steep Point, at the northern end of Finlayson Channel, British Columbia, sinking in thirty minutes. Two hundred lives were saved, and five lost, among the latter being Eccles.

Eccles, the operator, had been in wireless conversation with Booth, the operator at Ketchikan, Alaska, just before the Ohio struck a rock. Suddenly Eccles interrupted the inconsequential talk with Booth to flash this message: "Ohio struck a rock—steamer sinking —send aid immediately or everybody will be lost."

Booth and Eccles at once sounded the S O S, to which responses came soon from two steamers, the Humboldt and the Rupert City.

Then came another message from Eccles to Booth: "Ohio sinking fast—can't hold out—passengers being taken off in small boats—Captain and crew will stick to last."

After a pause came a third message from Eccles to Booth: "Passengers all off and adrift in small boats—Captain and crew going off in last boat—waiting for me now. Goodbye * * * * *."

They were the last words that Eccles ever addressed to a fellow being. He went down with the vessel while the Captain and crew were waiting for him.

Next three vessels at short intervals ran ashore on the South Atlantic coast and managed to gain assistance by means of wireless. The steamer Zeeberg, on September 25, ran ashore on the south jetty of St. John's Bar, near Jacksonville, Fla., and was pounding



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on the rocks when the Clyde liner Arapahoe, which was equipped with radio apparatus, sighted her distress signals, and sent out calls which brought the much needed aid. On November 20 the steamer Breakwater, of the Atlantic Fruit Company, ran ashore in a gale six miles from Diamond Shoals lightship. The wireless station at Cape Hatteras received the distress messages from the lightship and summoned the wrecking tugs Merritt and Coley, which took off all thirty persons before the vessel was ground to pieces by the shoals. The third accident occurred on December 1, when the steamer Nueces of the Mallory Line, while bound from New York for Key West and Galveston, ran aground on French Reef, off the Florida coast, in a thick rain squall. Wireless distress calls sent through the Key West station brought the Lampasas and the Government tug Osceola to her assistance.

*Donald C. Perkins, wireless operator on the wrecked steamship State of California*

It would almost appear that whether through fortutious circumstances or elemental disturbances, stranding accidents are prone to occur in groups on similar coast lines. The next four accidents of this character took place on the Pacific coast of North America. The first of this series occurred on October 28, 1910, when the steamer Charles Nelson of the Charles Nelson Lumber Company went ashore a few miles north of Point Arena, Cal., in a thick fog. The sending of a wireless call resulted in bringing the United States revenue cutter McCullough to the rescue. Then, on December 1 the steamer Northwestern of the Alaska Steamship Company was wrecked off Falee Bay, San Juan Island, Wash., while bound from Seattle to Cordova, Alaska. The steamer Tees responded to the S O S call and all on board were saved. Nine days later the Olympic, also of the Alaska Steamship Company, was wrecked on a reef off Bligh Island, Alaska. In this instance Government launches answered the S O S call and 123 persons were saved. The fourth of the series occurred on January 26, 1911, when the steamship Cottage City of the Pacific Coast Steamship Company was wrecked on a reef off Quadra Island, North British Columbia, in a blinding snowstorm and heavy fog. The S O S call brought aid from Victoria, British Columbia, and Port Townsend, Wash., and all on board were rescued.

In another Pacific catastrophe, on April 11, wireless aid was responded to by Japanese and Chinese ships when the Asia of the Pacific Mail Steamship Company sank off Finger Rock, South China. Her wireless distress signals were answered by the American Maru and the Chinese vessel Shang Siu. The passengers, crew and mails were saved.

The last two stranding events during 1911 occurred at widely distant points. The steamship Prinz Joachim, on November 22, struck rocks at Atwood Bay, Samana Islands. Wireless communication was established direct with New York City, and all on board were carried to safety. On December 13 the steamship Delhi was reported in distress off Cape Spartel, on the coast of Morocco. Assistance was obtained by aerial messages, and eighty-six passengers, 235 members of the crew and 3,500 tons of general cargo were saved.

In the year 1912, as though by a compensatory dispensation of Providence, owing to the great tragedy of the Titanic, there were comparatively fewer sea tragedies. Only two stranding accidents were recorded, and these, thanks to the wireless, were not of a serious nature. The Pleiades on August 16, ran ashore at Magdalena Bay. The operator, G. Bennett, summoned aid by aerial message, and all on board were taken off. On December 5 the steamer Easton, of the United States & Dominion Transportation Company, struck on Iroquois reef in Lake Superior. Wireless calls were answered by stations at Port Arthur, Ont., and Duluth, Minn. Tugs sent to the assist-

*George C. Eccles, hero of the steamship Ohio disaster*

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ance of the stranded steamer released her from her predicament with slight damage.

During the following year, however, many vessels were driven ashore and were wrecked on rocks, with heavy losses in life and property, but notwithstanding the year was a notable one in demonstrating the humanitarian value of the Marconi service and the promptitude and heroism of its vigilant operators. The Pacific coast of North America took an unusually heavy toll of the year's casualties, beginning on January 7, 1913, when the steamship Rosecrans was wrecked. Despite the distress calls which were sent out by L. A. Prudhunt, Marconi operator, only one life could be saved, while thirty-eight were lost. Then the Robert Dollar, while crossing the Columbia River bar, struck heavily, but, not locating any damage, proceeded on her voyage to Japan, only to find, when 100 miles off shore, that her stern post and rudder had broken off close to her counter, leaving her helpless in a big sea and a high wind. The Marconi operator on board established communication with shore, and a tug was sent to the aid of the helpless steamer within a few hours.

Quick action in summoning aid by wireless on the part of C. F. Hutchins and E. G. Bicak, Marconi operators on board the steamship Yukon, on June 13, when the vessel struck a reef off the Alaskan coast and sank, resulted in the saving of all who were on the wrecked vessel. The same efficiency on the part of the Marconi operator, R. H. Brower, six days later, resulted in the rescue of all on board the steamer Riverside, when she was wrecked and sunk off the California coast.

Another Alaskan reef, this time one in Gambier Bay, caused the loss within three minutes of the steamship State of California. Donald C. Perkins, the Marconi operator on the vessel, stuck to the sinking ship long enough to send out the S O S call, which was picked up by the Jefferson of the Alaska Steamship Company which fortunately was only a short distance away. The Jefferson saved seventy persons found in life boats and on rafts, although there was a loss of thirty-three lives in the disaster.

The steamer Spokane on October 3 went ashore on the beach off Cape Lazo, B. C., and the Marconi operator on board promptly summoned the freighter La Touche to the scene. Other vessels, the Dolphin, the Alki and the Minnesota also responded, but not until after the survivors of the stranded vessel had been picked up from the life boats.

Again, when the steamship Merced was wrecked off Point Gorda, Cal., on October 15, Marconi Operator Phair pluckily remained in the wireless room, sending out the S O S until he had received responses from three vessels, which sent word that they were hastening to the relief of the stranded steamship. Not until then did Phair leave the Merced. All on board had already taken to the small boats, and after the Marconi man joined them the ship was broken to pieces by the surf. Of the three rescuing steamships, the Atlas was the first to arrive, and took all the survivors on board.

Similar bravery was displayed by Marconi Operator Orth on the Stanley

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Dollar, when that vessel, on October 23, struck the Viti rocks on the Pacific coast. Orth kept sending out distress calls from the wrecked vessel until he received replies from the Tahoma, which sped to the rescue. The latter vessel two days later succeeded in hauling the Stanley Dollar off the rocks.

It is not only the ocean travelers on passenger liners, the crews of freighters or tank steamships that base their hope for aid on the Marconi service when the hour of trouble comes. Many a pleasure yacht, sailing southern waters, struck by squalls or run ashore in a tempest, has to thank the wireless for the boon of safety when danger threatens. On November 13, the yacht Wakiva ran ashore 180 miles south of Galveston. In response to the S O S call from the wireless operator on board, the Galveston station of the Marconi Company promised immediate aid, and soon after sent the tug Senator Bailey to the rescue of the yacht. A similar timely rescue was effected when the Vanderbilt yacht Warrior ran aground near Savanilla, on the coast of Colombia, on January 26, 1914. The wireless call was answered by the United Fruit Company's steamship Fruitera. Eight of that vessel's lifeboats were crushed like eggshells or overturned in the sea in vain attempts to reach the yacht. Then the steamship Almirante, forty miles distant, was summoned, and she succeeded in taking off all the Warrior's passengers, among whom were Mr. and Mrs. Frederick W. Vanderbilt, the Duke and Duchess of Manchester and Lord Arthur George Keith-Falconer.

Nearly two weeks previous to this, on January 13, the Royal Mail Steamship Cobequid lost her bearings in a blinding blizzard and stranded on Trinity Rock, in the Bay of Fundy. Thirty-six hours after the first wireless appeal was sped over the waters, the 108 persons on board had been rescued. Help came to the vessel just as the cannonading of the terrific seas was beginning to break her to pieces. The crash had come just before dawn, and a few minutes later the S O S was flashed out by the Cobequid's chief operator, J. W. Hitchner, who was unable to give her exact location, since no one on board knew it definitely. The flood tide and the gales broke the vessel's back and flooded the engine room, putting out the fires and interrupting the wireless service. The Westport, a coastal steamship, was the first vessel to reach the stricken craft, and in conjunction with another rescuer's timely arrival, all on board were saved as by a miracle. The rescue was one of the most remarkable known to ocean history, and it was remarked at the time that, since wireless telegraphy first triumphed over the forces of nature, its effectiveness was never more forcibly demonstrated. In the circumstances of the wreck, every other manner of signaling device would have proved inefficacious. Sirens could not have made themselves heard nor could "flare-ups" have been seen through the thick blanket of fog that lay on the water.

This year—1914— was one also notable for the numerous casualties due to the stranding ships. One of the most perilous adventures was experienced by the Roma of the Fabre Line, bound from Marseilles for Providence and New York, with 427 passengers and a crew of 100 aboard. The vessel was in peril for hours on No Man's Land, south of Gay Head, Martha's Vineyard, when, on February 16, she struck in a blinding snowstorm. No Man's Land loomed ahead, and suddenly the vessel was ashore. The Captain directed the operator to send out a wireless call, asking that a towboat be sent to the scene. The revenue cut-

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ters Acushnet, Itasca and Gresham, as well as towboats at New London, were rushed to the aid of the steamer, which was soon freed from her perilous position.

While seas were threatening to demolish the Red Cross liner City of Sydney, which ran on Sambro Rocks, twenty-five miles east of Halifax, N. S., March 17, wireless messages brought the tug Rosemary and other vessels to the rescue of those on the stranded craft. Fifty-three persons were taken from the ship and landed at Halifax.

Marconi Operator Dickow, on the steamship Pectan, managed to save that vessel from a dangerous predicament in April, when she ran aground off Adam's Cove, Cal. Dickow sent a wireless call for assistance to the Argyl. This vessel and the Lansing promptly arrived at the scene, but to the general dismay it was found that the rescuing ships were too large to enter between the perilous rocks on the coast. The wrecker Iaqua was then summoned and succeeded in pulling the distressed vessel off the rocks.

Two Marconi operators on the Northland of the Maine Steamship Line, H. Bondeaux and Carl Krech, were prompt in taking measures to save the passengers aboard the vessel when she ran hard aground on the rocks of Bartlett's Reef in Long Island Sound in the fog on the morning of June 5. The passengers were taken off by the Tasco, an ocean-going tug, which responded to the wireless summons from New London, Conn.

Wireless again saved all the passengers and crew in a midsummer wreck when the Prince Albert, on August 17, went ashore on Butterworth Rocks during a dense fog. Then in October, the Almirante of the United Fruit Company, the steamer which played the part of rescuer to the Vanderbilt yatch Warrior in October of the previous year, herself was stranded at Cartagena Harbor. Through the use of her wireless, the sixty-six passengers and ninety members of the crew were rescued, not a single life being lost.

Marconi Operator H. C. Rodd was of prompt service to his ship, the Lakeland, which went ashore eight miles from Alpena, Lake Huron, on November 10. Rodd sent out distress signals, which were answered by Marconi shore stations at Cleveland, Buffalo and Tobermory. The tug Favorite was informed of the accident and was quickly on hand to aid the distressed vessel. Constant wireless communication was maintained between the tug and the Lakeland while the former was on her way. The Lakeland was later towed into Port Huron.

Loren A. Lovejoy and Adolph John Svenson, Marconi wireless operators, distinguished themselves by unusual heroism on November 23, during the wrecking of the steam schooner Hanalei, which struck a reef opposite the transmitting station of the Marconi trans-Pacific service at Bolinas, Cal. Pounded by seas until the wireless cabin was washed away and the apparatus was placed out of commission, the vessel broke up almost in the very shadow of the Bolinas towers. Svenson, who had stuck to the wireless cabin to the last, managed to have his S O S picked up by the Marconi station at San Francisco, and the revenue cutter McCullogh and the oil tankers El Segundo and Richmond were soon at the scene of the wreck. But heavy seas and the surrounding reefs prevented their going to the relief of the distressed vessel. Darkness came on and communication with the shore was cut off. But the quick wit of Lovejoy found a way to overcome this difficulty, and for many hours through the night he managed to signal to the watchers on the beach by means of his pocket flashlight. Through his efforts the work of rescue was considerably facilitated and the courage of those on the wreck was strengthened.

When the vessel was abandoned Lovejoy had a thrilling experience on a raft, but was picked up and saved. His fellow operator on the Hanalei, Svenson, was not so fortunate. Svenson, who had remained in the cabin to the last, sending out the S O S call that summoned the steamers, and who later did all he possibly could do to prevent loss of life, was hurled into the sea when the ship broke in two and was drowned.

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The Marconi men on shore were not idle during all this time. The flashlight signals of Lovejoy were answered by Manager Baxter of the Bolinas station. He and others from the station waded into the surf, and while the seas were demolishing the ship, they snatched drowning folk from the waters. Bonfires were kindled on the beach to warm and cheer the rescued, and the Marconi Company's hotel was thrown open as a refuge. There were sixty-three persons on the Hanalei, of whom forty-three were saved.

The year wound up with an accident to the steamship Isthmian, on December 19, when the vessel struck the rocks off San Benito Island. In response to the S O S call, the cruiser West Virginia, torpedo boat destroyer Perry and the Navy tug Iroquois arrived and effected a rescue.

The shipping disasters of the year 1915 opened on January 1, when the steamship Obidense struck the Shipwash Sands. The call for assistance was sent by radio, and several ships responded, resulting in the saving of the entire crew, numbering forty-two persons. Then a week later, another accident occurred to the steam yacht Wakiva, which went on the rocks off the Tampico, Mexico, breakwater at night. The vessel was abandoned and those on board were rescued by means of the breeches buoy. Marconi Operator P. Daniels was in charge of the wireless on board the yacht. He at once sent out the S O S which was picked up by the operators on several vessels. Guy H. Hawkins, the Marconi operator on board the Brabant, bound from Tampico for New York, received the S O S. The Brabant reached the wreck just as the breeches buoy had been rigged up from the foremast of the yacht and anchored to a large concrete rock at the end of the jetty. This enabled all on board to reach the shore in safety.

Two days later there occurred another accident at the Tampico breakwater, when the Mexicano of the Pierce Navigation Company went ashore there. The Marconi operator sent out wireless distress calls, which were answered by the Mexican Government station at Tampico. The vessel was floated by tugs.

With aid summoned by wireless, the passengers and crew of the steamship Colon, which was stranded off the bar at Topolobampo on February 4, were safely taken off by the United States steamships Maryland and Annapolis. A wireless summons also was effective in salving a cargo of 40,000 sacks of sugar from the steamship Balmes, which, on March 30, stranded on a reef thirty miles west of Key West. The wireless request for aid was answered by the Key West Naval wireless station, which was instrumental in sending salvers to the wreck. The wireless message for aid also succeeded in saving the steamship Mexico of the Pacific Steam Navigation Company, which, on April 1, ran aground near Southwest Pass, La. Tugs summoned by wireless managed to float the vessel.

Charles F. Trevatt was the Marconi wireless operator on board the steamship Minnesota, when, on April 11, she ran on a reef at the entrance to the Inland Sea in Japan. The vessel struck with a terrific jolt. No sooner had the disaster occurred than Trevatt flashed the S O S. The call was taken up by the Blue Funnel liner Onfa, which, within an hour, was anchored within three miles of the wrecked vessel. Steps were at once taken to pull the Minnesota off the reef, and suddenly with an immense splash she slid safely into deep water, and was enabled to proceed on her voyage.

Wireless brought powerful tugs to the assistance of the steamship Asuncion on May 7, when she went ashore off Fraser River, and she was soon set free. Tugs were also summoned by aerial message to the assistance of the Alliance, when she was stranded at Richmond Beach, Washington, on June 3. The tugs that responded to the S O S call succeeded in taking off all on board, numbering forty persons.

L. F. Whitehead and H. D. Phillips were the Marconi operators on the steamship A. W. Perry of the Plant Line, plying between Boston, Halifax and Prince Edward Island. On June 8, during a fog, the vessel went on the rocks at Chebucto Head, N. S., with a crash and a bump, while she was two days out from Boston. The two wire-

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less men flashed the S O S signals. Shore stations answered the calls for aid and summoned the relief vessels. A wrecking boat was soon on the scene through the promptness of the wireless operators, and it took off the forty-two passengers and crew. The Perry went down.

There followed in swift succession during the summer months six strandings, in each of which the wireless was of great service in saving passengers, crews, cargoes and vessels. The California of the Anchor Line on June 28 ran ashore at Tory Island, the wireless calls bringing a British destroyer to the assistance of the wrecked vessel, from which the passengers were removed. On July 2, the steamer Panuco grounded at the entrance to South Pass, La., with a crew of thirty-five men aboard. The wireless promptly brought aid in floating the vessel. On July 11, the aerial calls brought rescuers to the steamship Invermore, which was wrecked near Brig Harbor, Labrador, and the crew was taken off. On August 2 wireless brought help to the Georgian, which went ashore near San Francisco in a fog. The Harvard responded to the call and all on the stranded ship were saved. On August 18 the El Sud of the Morgan Line grounded on Galveston Bar during a Gulf hurricane. Wireless calls brought immediate assistance and the vessel was towed into Galveston harbor after the weather had moderated. Finally, on August 23 the steamer Metapan grounded at Cartagena Harbor, with forty-five passengers and a crew numbering ninety-two on board. Assistance summoned by wireless facilitated the discharging of the cargo into lighters, and the steamer was subsequently floated.

A later series of accidents wound up the events of the year. On October 8 the steamship Mariposa of the Alaskan Steamship Company grounded and sank on a rocky shore in Llama Passage, off Pointer Island, British Columbia. Wireless operators despatched the S O S, which was responded to by two vessels. The Despatch, being within thirty miles, was on the scene in time to save the lives of the 139 persons on board. On November 2 the steamship Santa Clara was wrecked near the entrance to Coos Bay, 170 miles south of Astoria. Wireless calls succeeded in bringing out a vessel to the rescue. Ninety-three persons were thus saved, but not before fifteen passengers and twenty-four members of the crew were drowned. Three days later the steamer Fort Bragg grounded in the Gulf of California. The U. S. S. San Diego responded to the distress call in time to save the lives of forty-seven persons.

It had been a year of serious and numerous disasters. Small wonder at the statement issued by the radio inspectors of the Bureau of Navigation, who reported twenty-six cases of vessels leaving our ports, which had met with accident or disaster requiring the use of wireless to summon assistance. Of these four summons were for fire; twelve for running ashore, stranding or getting into ice jams; three for breaking machinery; four for collisions; one for shifting of cargo; one for a vessel which had been storm-battered and one which had been torpedoed.

The Marconi wireless continues to prove its humanitarian offices in the reports of stranding accidents ushered in by the present year. On January 17, the Car Ferry Pere Marquette No. 19 went aground four miles north of Ludington. Wireless communication was established with Ludington and Pere Marquette Car Ferries No. 17 and No. 18, which were advised not to come in close on account of shoal water. Wireless continued to be used, however, throughout the salvage operations.

The big trans-Pacific passenger ship, Chiyo Maru, grounded in a fog on the morning of March 31, on one of the Lema Islands, south of Hong Kong A wireless call for assistance was sent out, and a British destroyer, which was in the vicinity came to the rescue at full speed. There was a heavy swell, and oil was poured on the water. There were 229 passengers on board who were rescued from the lifeboats, to which they had taken, by the destroyer.

*(To be concluded)*

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# Engineers Entertained in Seattle

*Guests at the dinner given to the visiting members of the Institute of Radio Engineers. Sitting, reading from left to right, Roy A. Weagant, V. Ford Greaves, Philip Farnsworth, Lieutenant-Commander W. B. Wells, L. F. H. Betts, R. H. Marriott (toastmaster), Greenleaf W. Pickard, Frank N. Waterman, Frederick A. Kolster, Ellery W. Stone, A. A. Paysee and C. B. Cooper; standing, third from the left, Lieutenant E. J. Blankenship; fourth, C. A Kilbourne*

Members of the Institute of Radio Engineers and their guests visiting in Seattle were tendered a dinner by the Seattle Section of the Institute at the Butler Hotel in that city, on March 18. The dinner was given in honor of Frank N. Waterman and Greenleaf W. Pickard, wireless experts; Frederick A. Kolster, assistant physicist of the United States Bureau of Standards; V. Ford Greaves, radio engineer of the Department of Commerce; Lieutenants E. J. Blankenship; Dr. Frederick Osborne; Dr. Carl E. Magnusson; R. A. Weagant, chief engineer of the Marconi Wireless Telegraph Company of America and A. H. Ginman, general superintendent of the Marconi Company's Pacific Coast Division, together with their guests, L. F. H. Betts, D. N. Cosgrove and Judge Jere Neterer.

"These men," read the invitations sent out by R. H. Marriot, expert radio aide of the Navy and chairman of the Seattle Section of the Institute of Radio Engineers, "have accomplished important work in the radio field of engineering which as radio men, engineers and citizens of the Northwest, we should take opportunity to recognize."

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## ORDERS BY WIRELESS TELEPHONE TO BATTLESHIP

Standing on the bridge of the battleship New Hampshire in Hampton Roads, on the afternoon of May 6, Captain Lloyd H. Chandler, the commander of that warship, talked by wireless telephone with army and navy officers assembled around the desk of Secretary Daniels in Washington. The conversation between Captain Chandler and these officers was carried on as easily as if they had been standing in the same room, and continued nearly half an hour. Compliments were exchanged and orders were given by wireless telephone direct from the office of the Secretary of the Navy, to a ship at sea for the first time in history.

At the same time Secretary Daniels and other navy officials talked by long-distance telephone with the naval stations at Norfolk, New York, Chicago, San Diego, Pensacola, and other points, exchanging messages and giving official orders by word of mouth over thousands of miles of territory. Secretary Daniels was able to talk with the Commandant at the New York Navy Yard one minute, and the next minute he was talking with the Commandant of the Naval Station at San Diego. It took only twenty-eight seconds to make the telephone connection between Secretary Daniels's office and the Naval Station at San Diego and twenty-seven seconds to connect with the New York Navy Yard.



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# Standardization of Wireless Terms

*Report of the Committee of the Institute of Radio Engineers*

THE report of the Committee on Standardization of the Institute of Radio Engineers, which has just been presented for the year 1915, explains its mission as follows:

"The early history of new branches of engineering always shows the discouraging spectacle of a confused and ill-defined nomenclature, together with widely different meanings assigned to graphical and literal symbols by the various investigators and authors. As a result, there arise many unfortunate misunderstandings and a considerable amount of needless labor on the part of the practicing engineer and students of engineering. It therefore becomes desirable for the chief engineering institute in the new field to bend its best efforts in the direction of remedying such confusion through activities carefully carried on by a Committee on Standardization.

"The field of radio engineering is far from having escaped the objectionable conditions mentioned, as may be easily seen on reading either theoretical papers in this field or by a study of the reports of patent lawsuits."

As a result of sixteen regular meetings, and a number of less formal conferences, the committee presents the present report to the membership of the Institute and other workers in the radio field. It announces that it welcomes pertinent suggestions and criticisms of the present report as well as the views of those interested as to the proper future scope of standardization.

## Definition of Terms

**NOTE: Terms are generally arranged alphabetically according to the noun referred to.**

1. **Absorption, Atmospheric:** That portion of the total loss of radiated energy due to atmospheric conductivity.
2. **Ammeter** } **Hot Wire:** An ammeter
   **Hot Band:** }
   dependent for its indications upon the change in dimensions of an element which is heated by a current through it.
3. **Ammeter, Thermo:** An instrument for measuring current, depending for its indications on the voltage generated at the terminals of a thermo junction heated either directly or indirectly by the current to be measured.
4. **Amplifier** or **Amplifying Relay:** An instrument which modifies the effect of a local source of energy in accordance with the variations of received energy; and, in general, produces a larger indication than could be had from the incoming energy alone.
5. **Amplification, Coefficient of:** The ratio of the useful effect obtained by the employment of the amplifier to the useful effect obtained without that instrument.
6. **Antenna:** A system of conductors designed for radiating or absorbing the energy of electromagnetic waves.
7. **Antenna, Directive:** An antenna having the property of radiating a maximum of energy in one (or more) directions.
8. **Antenna, Flat Top:** An antenna having horizontal wires at the top covering a large area.
9. **Antenna, Harp:** An antenna having an approximately vertical section of large area and considerable width.
10. **Antenna, Inverted L:** A flat top antenna in which the leading down wires are taken from one end of the long, narrow horizontal section.



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11. **Antenna, Loop:** An antenna in which the wires form a closed circuit, part of which may be the ground.
12. **Antenna, Plain:** An approximately vertical single wire.
13. **Antenna, T:** A flat top antenna in which the horizontal section is long and narrow, the leading down wires being taken from the center.
14. **Antenna, Umbrella:** One whose conductors form the elements of a cone from the elevated apex of which the leading down wires are brought.
15. **Antenna Resistance:** An effective resistance which is numerically equal to the ratio of the power in the entire antenna circuit to the square of the R. M. S. current at a potential node (generally the ground).

    Note: Antenna Resistance includes

    Radiation resistance
    Ground resistance

    Radio frequency ohmic resistance of antenna and loading coil and shortening condensers.

    Equivalent resistance due to corona, eddy currents, and insulator leakage.
16. **Arc:** The passage of an electric current of relatively high density through a gas or vapor the conductivity of which is mainly due to the electron emission from the self-heated cathode. Under present practical conditions, the phenomena take place near atmospheric pressure.
17. **Arc Oscillator:** An arc used with an oscillating circuit for the conversion of direct to alternating or pulsating current. The oscillations generated are classified as follows:

    Class (1). Those in which the amplitude of the oscillation circuit current produced is less than the direct current through the arc.

    Class (2). Those in which the amplitude of the oscillation circuit current is at least equal to the direct current, but in which the direction of the current through the arc is never reversed.

    Class (3). Those in which the amplitude of the initial portion of the oscillation circuit current is greater than the direct current passing through the arc, and in which the direction of the current through the arc is periodically reversed.
18. **Attenuation (Radio):** This is the decrease, with distance from the radiating source, of the amplitude of the electric and magnetic forces accompanying (and constituting) an electro-magnetic wave.
19. **Attenuation, Coefficient of (Radio):** The coefficient, which, when multiplied by the distance of transmission through a uniform medium, gives the natural logarithm of the ratio of the amplitude of the electric or magnetic forces at that distance to the initial value of the corresponding quantities.
20. **Audibility:** The ratio of the telephone current variation producing the received signal, to that producing an audible signal. (An audible signal is one which permits the mere differentiation of dots and dashes.)

    The measurement of audibility is an arbitrary method for determining the relative loudness of telephone response in radio receivers, in which it is stated that a signal has an audibility of given value. The determination of the above ratio may be made by the non-inductive shunt-to-telephone method, except that a series resistance should be inserted to keep the main current constant, and that the shunt resistance should therefore be connected as a potentiometer.
21. **Brush or Coronal Losses:** Those due to leakage convection elec-

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tric currents through a gaseous medium.

22. **Cage Conductor:** A group of parallel wires arranged as the elements of a long cylinder.

Note: Any conducting element of an antenna may be a cage conductor.

23. **Capacity, Effective, of an Antenna:** The effective capacity and effective inductance of an antenna at any oscillation frequency are the equivalent capacity and inductance values determined from the following fundamental equations:

$$\omega = \sqrt{\frac{1}{LC}} \quad . \quad . \quad . \quad . \quad . \quad (1)$$

where $L$ = the total antenna inductance,
$C$ = the total antenna capacity,
$\omega$ = the angular velocity of the free alternating currents in the antenna.

$$d = \pi R \sqrt{\frac{L}{C}} \quad . \quad . \quad . \quad (2)$$

or $$d' = \pi R' \sqrt{\frac{C}{L}} \quad . \quad . \quad . \quad ((2a)$$

where $R'$ = series resistance inserted at the base of the antenna and
$d'$ = increased decrement resulting therefrom.

Solving (1 and (2a) for $L$ and $C$, we have

$$L = \frac{\pi R'}{\omega d'} = \frac{R'}{6 \times 10^8 \times d'} . \lambda$$

($\lambda$ in meters)

$$C = \frac{d'}{R'} = \frac{d'}{6\pi^2 \times 10^8 \times R'} . \lambda$$

($\lambda$ in meters)

Having the antenna inductance and capacity, the resistance $R$ of the antenna can be determined from equation (2). This value of $R$ satisfies the fundamental equation:

$RI^2$ = power absorbed by the antenna,

where $I$ = current measured at base of the antenna.

Note: The equation

$$\text{and also } E = \frac{\pi R'}{d'} . I$$

$$I = \omega C E$$

defines an effective voltage $E$, which is the voltage approximately given by the equation,

Energy per spark $= C E^2$.

24. **Center of Capacity of an Antenna:** See Form Factor, Note 2.

25. **Changer, Frequency:** A device delivering alternating currents at a frequency which is some multiple of frequency of the supply current.

26. **Changer, Wave:** A transmitting device for rapidly and positively changing the wave length.

27. **Characteristic, Dynamic, of a Conductor:** (For a given frequency and between given extremes of impressed E. M. F. and resultant current through the conductor): This is the relation given by the curve obtained when the impressed E. M. F.'s are plotted as ordinates against the resultant currents as abscissas, both E. M. F.'s and currents varying at the given frequency and between the given extremes.

28. **Characteristic, Static, of a Conductor:** This is the relation given by the curve plotted between the impressed electromotive force as ordinates and the resultant current through the conductor as abscissas, for substantially stationary conditions.

29. **Coefficient, Attenuation, Radio:** See Attenuatoin.

30. **Coefficient of Amplification:** See Amplification.

31. **Coefficient of Coupling, Inductive:** The ratio of the effective mutual inductance of two circuits to the square root of the product of the effective self inductances of each of these circuits.

32. **Coherer:** A device sensitive to radio frequency energy, and characterized by (1) a normally high resistance to currents at low voltages, (2) a reduction in resistance on the application of an

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increasing electromotive force, this reduction persisting until eliminated by the application of a restoring or disturbing mechanical force, and (3) the substantial absence of thermo-electric or rectifying action.

33. **Communication, Radio:** The transmission of signals by means of electromagnetic waves originating in a constructed circuit.

34. **Compass, Radio:** A radio receiving device for determining the direction (or the direction and its opposite) in which maximum energy is received; or

A radio transmitting device for determining the direction (or the direction and its opposite) of maximum radiation.

35. **Condenser, Air:** A condenser having air as its dielectric.

36. **Condenser, Compressed Gas:** A condenser having compressed gas as its dielectric.

37. **Conductor, Cage:** See Cage Conductor.

38. **Corona:** See Brush or Corona Losses.

39. **Counterpoise:** A system of electrical conductors forming one portion of a radiating oscillator the other portion of which is the antenna. In land stations, a counterpoise forms a capacitive connection to ground.

40. **Coupler:** An apparatus which is used to transfer radio frequency energy from one circuit to another by associating portions of these circuits.

41. **Coupler, Capacitive:** An apparatus which, by electric fields, joins portions of two radio frequency circuits; and which is used to transfer electrical energy between these circuits through the action of electric forces.

42. **Coupler, Direct:** A coupler which magnetically joins two circuits having a common conductive portion.

43. **Coupler, Inductive:** An apparatus which by magnetic forces joins portions of two radio frequency circuits and is used to transfer electrical energy between these circuits through the action of these magnetic forces.

44. **Coupling:** See Coefficient of Coupling (Inductive).

45. **Current, Damped, Alternating:** An alternating current whose amplitude progressively diminishes. (Also called oscillating current.)

46. **Current, Forced Alternating:** A current, the frequency and damping of which are equal to the frequency and damping of the exciting electromotive force. See further Current, Free Alternating.

Note 1: During the initial stages of excitation, both free and forced currents co-exist.

47. **Current, Free Alternating:** The current following any transient electromagnetic disturbance in a circuit having capacity, inductance, and less than the critical resistance. See further, Resistance, Critical.

48. **Curve, Distribution, of a Radio Transmitting Station for a given distance:** This is a polar curve, the radii vectors of which are proportional to the field intensity of the radiation at that distance in corresponding directions. See also Compass, Radio.

Note 1: The distribution curve depends, in general, not only on the form of the antenna, but also on the nature of the ground surrounding the station.

Note 2: The distribution curve generally varies with the distance from the station.

49. **Curve, Resonance, Standard:** A curve the ordinates of which are the ratios of the square of the current at any frequency to the square of the resonant current, and the abscissas are the ratios of the corresponding wave length to the resonant wave length; the abscissas and ordinates having the same scale.

50. **Cyclogram:** See Characteristic, Dynamic.

51. **Cyclograph:** An instrument for the production of cyclograms.

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## STANDARD GRAPHICAL SYMBOLS

Alternator

Ammeter

Antenna

Arc

"Audion" — See Vacuum Tube, Three Electrode

Buzzer, Exciting

Coherer

Condenser, Audio Frequency

Condenser, Compressed Gas

Condenser, Radio Frequency

Condenser, Variable

Counterpoise

Coupler, Inductive

Coupler, Variable Inductive

Decremeter

Detector

## STANDARD GRAPHICAL SYMBOLS
( CONTINUED )

Detector, Magnetic

Frequency Meter

Gap, Non Synchronous

Gap, Quenching

Gap, Spark

Gap, Synchronous

Ground

Inductance

Inductance, Iron Core

Inductance, Variable

Insulator

Key

Key, Relay

Microphone

Motor Generator, D.C. to A.C.

Mover, Prime

## STANDARD GRAPHICAL SYMBOLS
( CONTINUED )

Receivers, Telephone

Relay — See Key, Relay

Resistance, Non-Inductive

Resistance, Variable

Telephone — See Receiver

Thermo Junction

Tikker

(Transformer.) Frequency Changer

Transformer, Iron Core

Transmitter, Telephone

Vacuum Tube, Three Electrode "Audion"

Vacuum Tube, Two Electrode "Valve"

Voltmeter

Wattmeter

Wavemeter

*Standard graphical symbols recognized by the Institute of Radio Engineers*

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52. **Decrement:** See Decrement, Linear, and Logarithmic.

53. **Decrement, Linear, of a Linearly Damped Alternating Current:** This is the difference of successive current amplitudes in the same direction divided by the larger of these amplitudes.

Note: Let $I_n$ and $I_{n+1}$ be successive current amplitudes in the same direction of a linearly damped alternating current.

Then, the linear decrement

$$b = \frac{I_n - I_{n+1}}{I}$$

Also: $I_t = I_o (1 - bft)$,

where $I_o$ = initial current amplitude,

$I_t$ = current amplitude at time $t$,

$f$ = frequency of alternating current.

54. **Decrement, Logarithmic, of an exponentially damped alternating current:** This is the logarithm of the ratio of successive current amplitudes in the same direction.

Note: **Logarithmic decrements are standard for a complete period or cycle.**

Let $I_n$ and $I_{n+1}$ be successive current amplitudes in the same direction,

$d$ = logarithmic decrement,

Then, $d = \log \Sigma \frac{I_n}{I_{n+1}}$,

where $\Sigma = 2.178+$.

55. **Decremeter:** An instrument for measuring the logarithmic decrement of a circuit or of a train of electromagnetic waves.

56. **Detector:** That portion of the receiving apparatus which, connected to a circuit carrying currents of radio frequency, and in conjunction with a self-contained or separate indicator, translates the radio frequency energy into a form suitable for operation of the indicator. This translation may be effected either by the conversion of the radio frequency energy, or by means of the control of local energy by the energy received.

57. **Device, Acoustic Resonance:** A device which utilizes in its operation resonance to the audio frequency of the received signals.

58. **Diplex Reception:** The simultaneous reception of two signals by a single operating station.

59. **Diplex Transmission:** The simultaneous transmission of two signals by a single operating station.

60. **Duplex Signaling:** The simultaneous reception and transmission of signals.

61. **Excitation, Impulse:** A method of producing free alternating currents in an excited circuit in which the duration of the exciting current is short compared with the duration of the excited current.

Note: The condition of short duration implies that there can be no appreciable reaction between the circuits.

62. **Factor, Damping:** The product of the logarithmic decrement and the frequency of an exponentially lamped alternating current.

Let $I_o$ = initial amplitude,

$I_t$ = amplitude at the time $t$,

$\Sigma$ = base of Napierian logarithms (2.718=),

$a$ = damping factor,

Then, $I_t = I_o \Sigma^{-at}$

63. **Factor, Form:** The form factor of a symmetrical antenna for a given wave length is the ratio of the algebraic average value of the R. M. S. currents measured at all heights to the greatest of these R. M. S. currents.

Note 1: For a given R. M. S. current at the base of the antenna, the field intensity at distant points is proportional to the form factor times the height of the antenna.

Note 2: The effective height (height of center of capacity) is equal to the form factor times the actual height of the antenna.

Note 3: The limiting values of

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the form factor for various types of antennas are as follows:

| Linear or Vertical Antenna | Flat Top Umbrella Antenna |
|---|---|
| Long Waves | |
| Lower Limit, $1/2$ | Upper Limit, 1 |
| Fundamental | |
| Lower Limit, $2/\pi$ | |

Note 4: The form factor varies in a given antenna at various wave lengths due to variation of the current distribution.

64. **Frequencies, Audio (abbreviated a. f.):** The frequencies corresponding to the normally audible vibrations. These are assumed to lie below 10,000 cycles per second.

65. **Frequencies, Radio (abbreviated r. f.):** The frequencies higher than those corresponding to the normally audible vibrations, which are generally taken as 10,000 cycles per second. See also Frequencies, Audio.

Note: It is not implied that radiation cannot be secured at lower frequencies, and the distinction from audio frequencies is merely one of definition based on convenience.

66. **Frequency, Changer:** See Changer, Frequency.

67. **Frequency, Group:** The number per second of periodic changes of amplitude or frequency of an alternating current.

Note 1: Where there is more than one periodically recurrent change of amplitude, or frequency, there is more than one group frequency present.

Note 2: The term "group frequency" replaces the term "spark frequency."

68. **Frequency Transformer:** See Changer, Frequency.

69. **Fundamental of an Antenna:** This is the lowest frequency of free oscillations of the unloaded antenna. (No series inductance or capacity.)

70. **Fundamental Wave Length:** The wave length corresponding to the lowest free period of any oscillator.

71. **Gap, Micrometer:** A device for protecting any apparatus from excessive potentials, and consisting of a short gap designed for fine adjustment.

72. **Ground:** A conductive connection to the earth.

73. **Height, Effective, of an Antenna:** See Factor, Form; Note 2.

74. **Inductance, Effective of an Antenna:** See Capacity, Effective of an Antenna.

75. **Impulse Excitation:** See Excitation, Impulse.

76. **Interference, Wave (In Radio Communication):** The reinforcement or neutralization of waves arriving at a receiving point along different paths from a given sending station; (to be distinguished from ordinary or station interference, which is the simultaneous reception of signals from two or more stations).

77. **Key:** A switch arranged for rapidity of manual operation and normally used to form the code signals of a radiogram.

78. **Key, Relay:** See Relay Key.

79. **Length, Wave:** See Wave Length.

80. **Losses, Brush** or **Corona:** See Brush or Corona Losses.

81. **Meter, Wave:** See Wave Meter.

82. **Oscillations (In radio work):** See Current, Damped Alternating.

83. **Oscillator, Arc:** See Arc Oscillator.

84. **Potentiometer:** As commonly used for radio receiving apparatus, a device for securing a variable potential by utilizing the voltage drop across the variable portion of a current carrying resistance.

85. **Radiation, Sustained:** See Waves, Sustained.

86. **Radiogram:** A telegram sent by radio.

87. **To Radiograph (verb):** To send a radiogram.

88. **Radio Telephone:** An apparatus for the transmission of speech by radio.

89 **Radiophone (noun):** A telephone message sent by radio.

90. **To Radiophone (verb):** To send a radiophone.

91. **Rectifier, Electron:** A device for

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rectifying an alternating current by utilizing the approximately unilateral conductivity between a hot cathode and a relatively cold anode in so high a vacuum that a pure electron current flows between the electrodes.

92. **Rectifier, Gas:** An electron rectifier containing gas which modifies the internal action by the retardation of the electrons or the ionization of the gas atoms.

93. **Relay, Electron:** A device provided with means for modifying the pure electron current flowing between a hot catheode and a relatively cold anode placed in as nearly as possible a perfect vacuum.

These means may be, for example, an electric control of the pure electron current by variation of the potential of a grid interposed between the cathode and the anode.

94. **Relay, Gas:** An electron relay containing gas which modifies the internal action by the retardation of the electrons or the ionization of the gas atoms.

95. **Relay, Key:** An electrically operated key. See further, Key.

96. **Resistance, Antenna:** See Antenna Resistance.

97. **Resistance, Critical, of a Circuit:** That resistance which determines the limiting condition at which the oscillatory discharge of a circuit passes into an aperiodic discharge.

98. **Resistance, Effective, of a Spark:** The ratio of the power dissipated by the spark to the mean square current.

99. **Resistance, Radiation:** This is the ratio of the total energy radiated (per second) by the antenna to the square of the R. M. S. current at a potential node (generally the ground connection). See further, Antenna Resistance.

100. **Resistance, Radio Frequency:** This is the ratio of the heat produced per second in watts to the square of the R. M. S. current (r. f.) in amperes in a conductor.

101. **Resonance:** Resonance of a circuit to a given exciting alternating E. M. F. is that condition due to variation of the inductance or capacity in which the resulting effective current (or voltage) in that circuit is a maximum.

Note 1: Instead of varying the inductance and capacity of a circuit the frequency of the exciting field may be varied. The condition of resonance is determined by the frequency at which the current (or voltage) is a maximum.

Note 2: The resonance frequency corresponds the more accurately to the frequency of the free oscillations of a circuit, the lower the damping of the exciting alternating field and of the excited circuit.

102. **Resonance, Acoustic Device:** See Device, Acoustic Resonance.

103. **Resonance, Sharpness of:** See Tuning, Sharpness of.

104. **Signaling, Duplex:** See Duplex Signaling.

105. **Sharpness of Tuning:** The measure of the rate of diminution of current in transmitters and receivers with detuning of the circuit which is varied.

If $d_2$ is the decrement of the free alternating current in the circuit of $d_1$ the decrement of the exciting E. M. F., then the sharpness of tuning is arbitrarily defined as $\frac{\pi}{d_1 + d_2}$.

106. **Spark:** An arc of short duration.

107. **Static:** Disturbances caused by atmospheric charging of the antenna.

Note: When it is definitely known that disturbances are due to atmospheric charging of the antenna, the word "Static" shall be used. In general, disturbances shall be called "Strays."

108. **Strays:** Electromagnetic disturbances set up by distant discharges.

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109. **Telegraphy, Radio:** The art of sending and receiving radiograms.
110. **Telephony, Radio:** The art of sending and receiving radiophones.
111. **Train, Wave:** The waves emitted which correspond to a group of oscillations in the transmitter. See also, Frequency, Group.
112. **Transformer:** In present radio practice the term should be restricted to audio frequency transformers. See Frequency, Audio.
113. **Transmission, Diplex:** See Diplex Transmission.
114. **Tuning:** The Process of securing the maximum indication by adjusting the time period of a driven element. See Resonance.
115. **Tuning; Sharpness of:** See Sharpness of Tuning.
116. **Vacuum Tube, Three Electrode:** As examples see Relays, Electron and Gas.
117. **Vacuum Tube, Two Electrode:** As examples see Rectifiers, Electron and Gas.
118. **Waves, Electromagnetic:** A periodic electromagnetic disturbance progressive through space.
119. **Wave Length (of an Electromagnetic Wave):** The distance in meters between two consecutive maxima, of the same sign, of the electric and magnetic forces.
120. **Wave Length, Fundamental:** See Fundamental Wave Length.
121. **Wave Length, Natural:** In a loaded antenna (that is, with series inductance or capacity) the natural wave length corresponds to the lowest free oscillation.
122. **Wave Changer:** See Changer, Wave.
123. **Wave Meter:** A radio frequency measuring instrument calibrated to read wave lengths.
124. **Waves, Sustained:** Waves radiated from a conductor in which an alternating current flows.
125. **Wave Train:** See Train, Wave.

The report also includes definitions of trade names and recommendations for tests and rating. The standard graphical symbols adopted are given on another page.

## THE REGULATION OF INTERNATIONAL COMMUNICATION

The International Telegraphic Union, of Berne, which regulates the international wireless stations, land lines and submarine cables of the world, has issued a bulletin. At the head of the Union is Emil Frey, ex-president of Switzerland and a veteran of the Civil War. By international agreement, first made in 1865 and reaffirmed at numerous conventions, the Union was formed to codify cable regulations and standardize the treatment of messages to all parts of the world. With the advent of wireless, the Union took charge of this branch of communication as well. At present Mr. Frey's work is particularly difficult, due to the European war and the consequent interruptions of the service.

Just now it is the wireless which is making the most rapid strides, and Mr. Frey finds it difficult to keep up with the sweep of this medium of communication to the remotest islands of the seas. Each government gets up a list of its own stations, but the Union consolidates the lists of all governments. The American section, for instance, allowing all army, navy and private wireless stations and all boats with wireless, includes even the yachts of Vincent Astor and others with wireless equipments.

## SERVICE BETWEEN KENTUCKY MINES

According to word from Louisville, Ky., the Harlan Coal Mining Company and Lick Branch Coal Company are preparing plans for wireless telegraph service between the several coal mines in Harlan County, Kentucky, and the main offices in Louisville. The sending apparatus will be located in the Black Mountains, Harlan County, where the Cumberland range reaches its highest elevation in Kentucky. The receiving end, it is stated, will be on the Starks building, Louisville. The distance on an air line is about 200 miles and by rail nearly 300 miles.

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# From and For those who help themselves

## Experimenters' Experiences.

*The editor of this department will give preferential attention to contributions containing full constructional details, in addition to drawings.*

### FIRST PRIZE, TEN DOLLARS
### A Closed Core Transformer That Has Several Advantages

The transformer that I am about to describe was designed in accordance with the article by R. H. Chadwick in the December, 1915, issue of THE WIRELESS AGE. If the directions given in this article are followed carefully the owner will be well satisfied with the results of his work.

First to be considered is the core. This is built of insulated laminations of silicon steel. The cross-section of the core is 2 inches by 2 inches, and the steel is 1/64 of an inch thick. One hundred and sixty pieces, 2 inches wide by 11 inches long, and 160 pieces, 2 inches wide by 6 inches long, shellaced on both sides, are required. These can probably be bought cut to the right size for about $1.50. If not, it is best to shellac the big pieces before cutting them as it is rather tedious to shellac a number of small pieces.

The core is built up as follows: Take one of the long pieces and place it on the table, then take another and place it on top of the first, so that one end will project 2 inches over the end of the first piece (Fig. 1). Take a third piece and put it in a position like the first, a fourth like the second, etc., until eighty pieces have been used. Repeat with the other eighty pieces and the core legs for the primary and secondary windings will be completed.

The next step is to find out the voltage of the A. C. mains. Do not take it for granted that it is 110, but find out by getting in communication with the electric lighting company. Having determined the voltage, the primary should next be considered.

For 110 volts four pounds of No. 14 D. C. C. wire will be needed; for 220, eight pounds. Take one of the legs of the core, wrap it with about six layers of empire cloth and fasten the empire cloth with tape. Begin winding one inch from the edge of the empire cloth and wind to within one inch of the other end. Then make a loop in the wire 4 inches long to take a tap from. Put one layer of empire cloth over the winding and start back again. Be sure that the wire in this second layer goes around the core in the same direction as that in the first. Continue winding in this way until 6 layers have been wound (12 layers for 220 volts), then fasten the wire. The whole primary should now be given a good coat of shellac to keep the end wires in place.

The secondary comes next in the order of construction. This is usually where the builder's troubles begin. The number of secondary turns is the same for 110 and 220. Eight pounds of No. 32 enameled wire are required, the cost being about $1.08 per pound. The secondary, should be wound on a lathe



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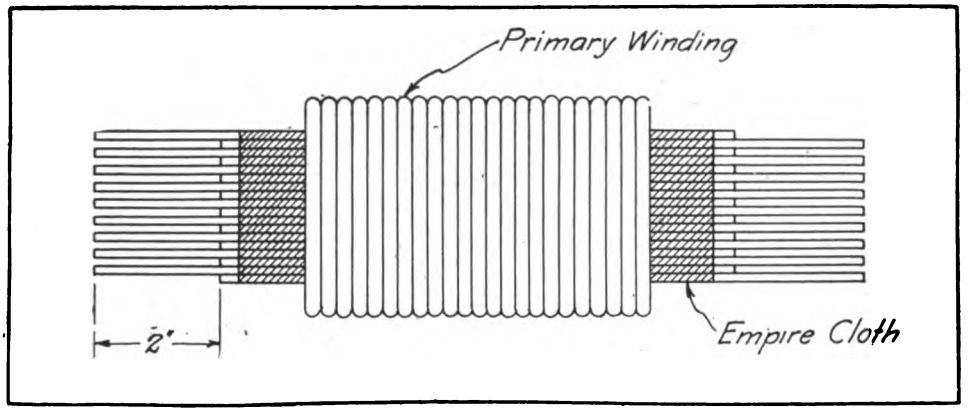


*Fig. 1, First Prize Article*

or a winding machine, and the wire must be run through hot paraffine while being wound.

The secondary is divided into twenty-four pies ¼ of an inch thick. Each pie is wound on a form (Fig. 2). If a winding machine is to be used, cut two

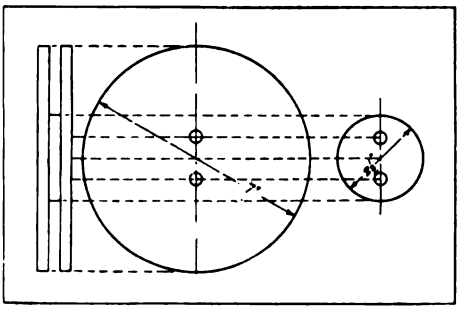

*Fig. 2, First Prize Article*

wood disks 7 inches in diameter for the sides of the form. If a lathe is to be used it is best to use the face plate for one side and screw the center disk and the other side of the form direct to the face plate.

A very good paraffine tank can be made as follows: Take a can (a baking powder can is about the right size, and cut out half of the cylindrical part, leaving both ends whole (Fig. 3). Solder the cover on the can and then drill hole A (Fig. 3), to take a small sized shaft. Use a small brass rod for the shaft, and put an empty spool on it. Then solder around the ends of the shaft. The spool should be wedged in place, as its purpose is to keep the wire well into the paraffine, not to act as a pulley. If it is allowed to turn it will throw the paraffine badly. The tank should be propped up about six inches and an alcohol lamp put under it to keep the paraffine hot.

To make the pies, wrap three or four thicknesses of paper around the center of the form so that the pie will come off easily; thread the wire through the paraffine, fasten it to the form, and then wind on 1,700 turns. If a lathe is used and it runs at constant speed, the best way to count the turns is by time. For instance, if the lathe is going at 170 R.P.M. wind for ten minutes on each pie. The lathe should not be run faster than 300 R.P.M. in any case.

After the twenty-four pies are wound, cut sixty-nine disks of empire cloth, 7 inches outside diameter and 2½ inches inside diameter. Then begin assembling the secondary on the core leg as follows: Take one pie and put four strips of tape around it (Fig. 4) so as to guard against possible loosening of the turns, and put it on the

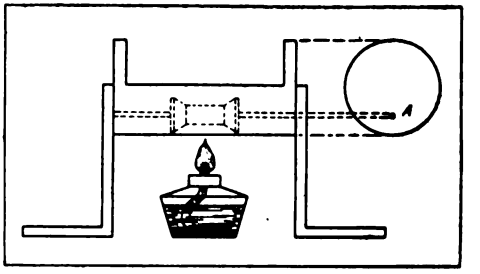


*Fig. 3, First Prize Article*

core one inch from the edge of the empire cloth. Then put on three disks of empire cloth and then the next pie,

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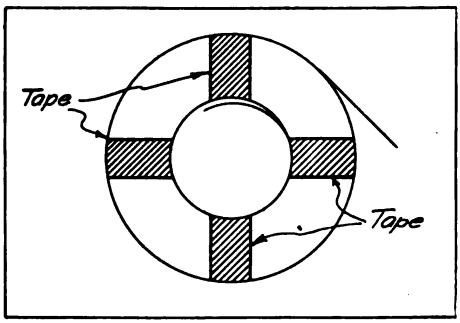


*Fig. 4, First Prize Article*

but put this pie on so that its wire runs the opposite way from that of the first. This is most easily understood by studying Fig. 5 carefully. Solder the two inside wires (those next to the core) together. Then put on three more disks of empire cloth and the third pie. The wire in this is to go in the same direction as that in the first one. Connect the outside wires of the second and third pies, the inside wires of the third and fourth, the outside wires of the fourth and fifth, etc., until all twenty-four have been put on.

The construction is now complete, except the assembling of the core. This is done by placing the primary and secondary legs in a parallel position 4 inches apart and building up the end, as shown in Fig. 6.

If properly constructed the transformer should give a heavy spark with a 50 watt lamp in series with the primary and a small condenser across the secondary. It will not heat at all, even on full power, and on low power will hardly "blink" the lights. The secondary voltage is 12,000, which makes the current easier to insulate than a higher voltage.

EDWARD M. SARGENT, *California.*

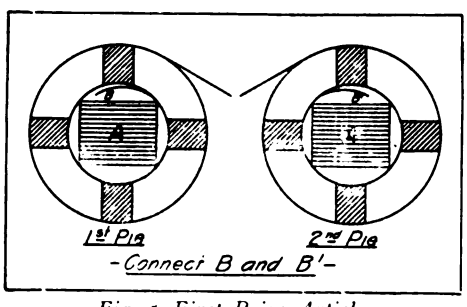


*Fig. 5, First Prize Article.*

## SECOND PRIZE, FIVE DOLLARS
### A Device for Measuring Wire During a Coil Winding

An amateur's laboratory is not completely equipped unless it has a device for measuring the wire during the process of winding a coil. With the device I have designed the wire, in order to be measured needs only to pass over a series of spools; thus the measuring and winding operation may be performed in a single stroke.

The construction of the measuring device is clearly shown in Figs. 1, 2 and 3. First cut from a 1 inch by 6 inch piece of hard wood stock the piece A, as in Fig. 1. It should be 8 inches in length. At one end attach the piece B in Fig. 1, this being cut from the same stock in such a manner as to leave pro-

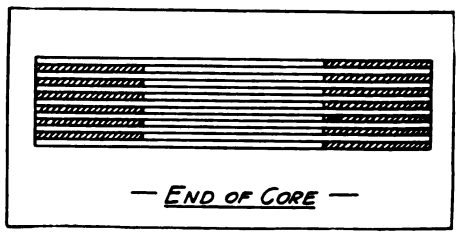


*Fig. 6, First Prize Article*

jections to carry friction wheels I and J (Figs. 1 or 2).

Next cut a measuring wheel as at C, Fig. 1 or 2. This should be 4½ inches in diameter, cut from the same stock. A groove finished flat, transversal to the radius, should now be cut until it has an exact length of 12 inches. The wheel is then placed on a shaft in D, Fig. 1, which projects through the end piece B and also through the bearing piece, E, and is attached to the revolution recorder, F, which is securely clamped to the block, G, in Fig. 1. A good recorder may be secured at any automobile or bicycle shop for a very nominal sum. A piece of iron rod, H, size optional, should be threaded at one end and placed in the board A at H (Fig. 1). This is intended for the spool of wire. The friction wheels, I, J, K, should next be made and attached as shown in Figs. 1 and 2. Also construct the wheel, F, counter to the wheel, L, the former being made to fit the flat groove of the latter. The ten-

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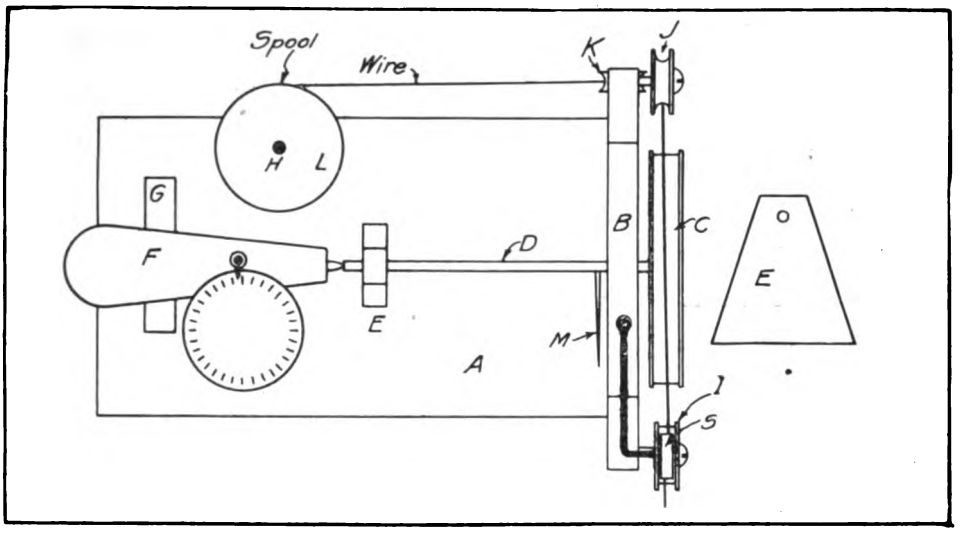


*Fig. 1, Second Prize Article*

sion wheel, S, should be mounted on a spring which is preferably adjustable so that in case of a break or stop the wire will not slip.

To operate the recorder proceed as follows: Run the wire from the spool L, in Fig. 1, under the friction guide, K, and over J, and continue it over and around the measuring wheel, C, and on through the tension holders, I and S. From this point the wire should be led directly to the tube being wound.

A pointer, M, in Fig. 1, should be made and placed in the shaft, D, close to the piece, B; cut a piece of white paper the size of the wheel, C, and calibrate it into twelve equal parts. Then glue it to the inside of the piece, B. The pointer will then indicate the number of inches and the revolution counter the number of feet which have passed the spot where the wires pass the top of the wheel, C. During the process of construction great care must be exercised to make all bearings and friction surfaces fit snugly yet loosely, thereby reducing all resistance and friction to a minimum, since too much tension might break or at least strain the insulation on very small wire.

MELVIN W. WALLACE, *Oregon.*

## THIRD PRIZE, THREE DOLLARS

### A Machine for Twisting Litzendraht Cable

Litzendraht consists of stranded wire cable with each strand insulated from the other. Amateurs frequently

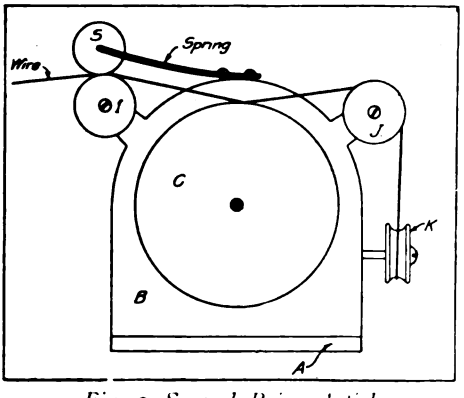


*Fig. 2, Second Prize Article*

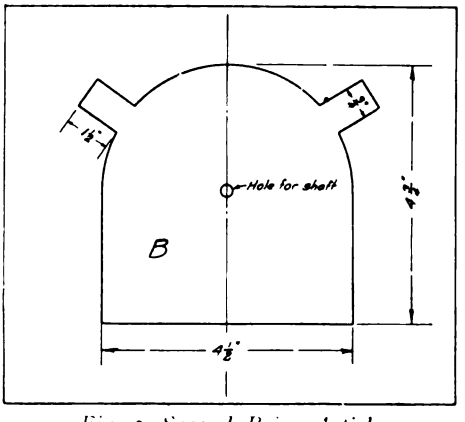


*Fig. 3, Second Prize Article*

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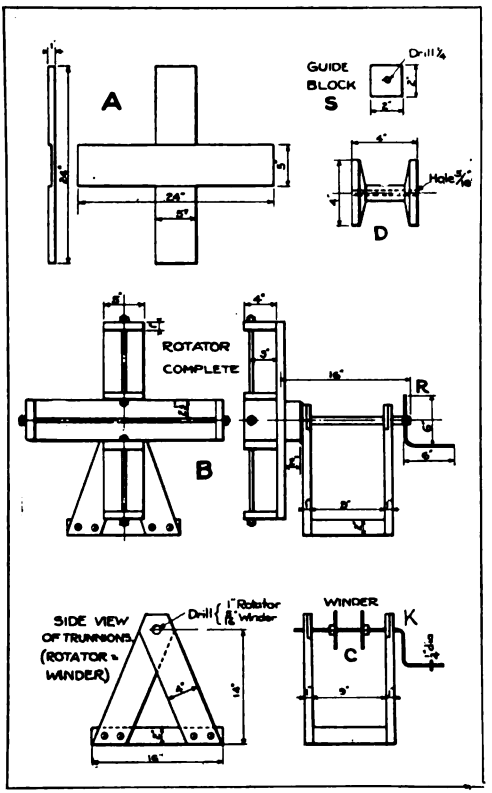
desire to make use of this wire, but after finding the price is about 30c. a foot, undertake to construct the cable themselves. But the task is found to be hopeless unless the apparatus suitable for making the stranded cable is understood. Litzendraht wire gives numerous advantages, particularly in the windings of tuners and radio frequency circuits; in fact, the use of this




*Drawing, Third Prize Article*

wire is imperative for a decremeter, as its constants are not altered by changes in frequency. In addition, the high frequency resistance of Litzendraht is very low; in fact, almost at the same value as the ohmic resistance. To some extent it eliminates the condenser effect, which is so objectionable in coils of ordinary enamelled wire. Again, if several strands of the wire should become broken, the entire circuit is not immediately interrupted. Repairs can be delayed till an opportune time.

A description of a machine for making Litzendraht which has withstood long and hard, yet successful service, follows:

Halve together two pieces of oak 1 inch in thickness, with other dimensions 24 inches by 5 inches, A. Secure a 16-inch length of 1-inch pipe and drill a hole half through the joint, A, that is a driving fit for the pipe. To strengthen this structure make an extra block, 2 inches by 5 inches by 5 inches, and drill a hole in it to fit over the pipe. Fasten it to the back of the joint. A piece of ¼-inch rod, 12 inches in length, is bent at right angles in the middle and is used as a crank. It is to be slipped through a hole drilled crossways in the pipe, 1 inch in from one end, and is made adjustable by a set screw. Make the trunnions for this as in the drawing. These should be made very carefully and strong, as the crank shaft that they support must run at high speed. Cut six pieces of wood, 1 inch in thickness, into rectangles 4 inches by 5 inches. One inch in from the 5-inch edge on each and also in the middle, drill a ¼-inch hole. Fasten these to the cross piece as per the drawing. Mount axles of ¼-inch steel fitted with nuts to hold them in place in these holes. After putting the crank in position, slide the pipe through the bearings and drive it into the hole in the cross piece. This part, the rotator, is now complete (B).

A proper winding mechanism must now be constructed and the actual design will vary with the materials at hand. A handy type is indicated in the accompanying drawing. It is self-explanatory (C). A guiding block must be used to bunch the wires. A piece of steel ⅜ of an inch in thickness and 2 inches by 2 inches must be secured; a ¼-inch hole should be drilled through its center. The hole is carefully countersunk on both sides and then filed and smoothed with emery to a glass-like finish. If there is the slightest roughness on this piece, it will break the wire or scrape off the insulation.

The simplest way to make up a Litzendraht cable is to purchase five pounds of No. 32 B. & S. enamelled

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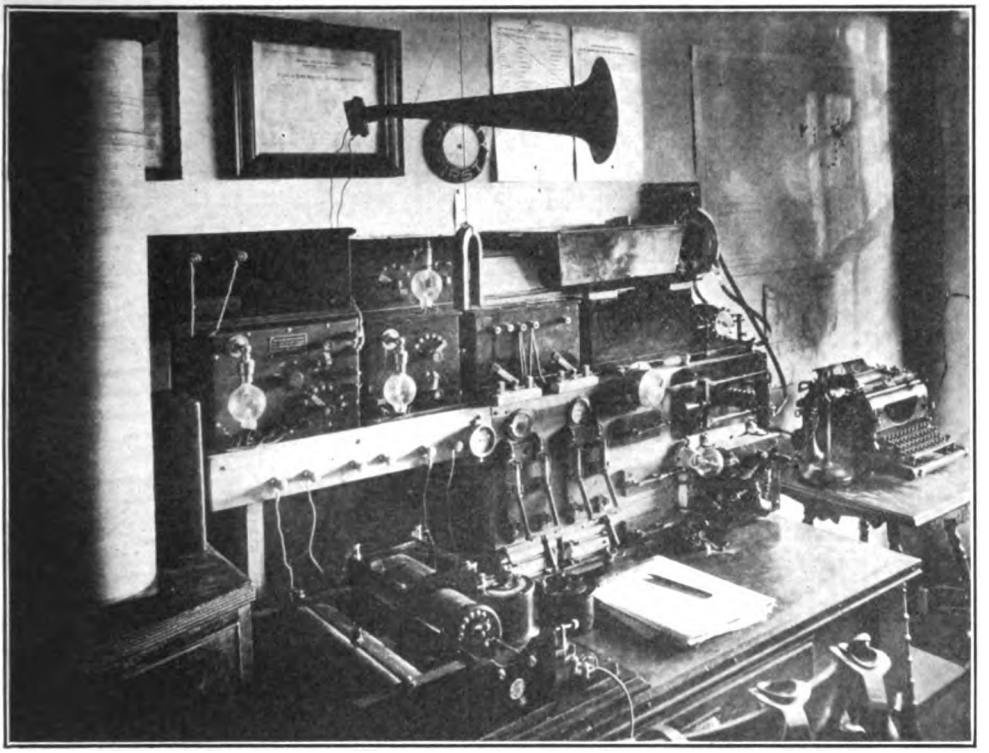

*Illustration accompanying Fourth Prize Article. Station of Chris. M. Bowman*

copper wire and one 1-pound spool and mount these on the rotator. However, any quantity desired may be used. Spools (D) can be purchased at any wire supply house for 10c. each, and the lot evenly divided among them. The spools on the rotator must all weigh the same.

A rather large spool must be used on the take-up reel. The rotator and the take-up reel should be mounted ten feet apart. The five strands of wire are then slid through the guiding block (F) and hooked on to the spool (K). Crank (R) should be rotated ten times to one of crank (K). The guide block (F) is held about 2 feet from the take-up reel.

There are 5,112 feet of No. 32 B. & S. enamelled copper wire to the pound, and a pound costs about $1.25. Thus Litzendraht cable made by this method costs about $0.00125 per foot. The resultant cable is about the size of No. 20 B. & S.

RAYMOND F. ADAMS,
*District of Columbia.*

## FOURTH PRIZE, SUBSCRIPTION TO WIRELESS AGE

### A Station With an Excellent Record for Long Distance Receiving

The wireless enthusiast is generally interested in wireless stations which have performed unusual long distance receiving work. Therefore a description and a photograph of my receiving station should be of interest to the readers of THE WIRELESS AGE. The transmitting and receiving apparatus are compactly mounted so that they are within reach of the operator who may remain in his chair. The transmitting set is of ½ k.w. to 1 k.w. capacity and derives its power from the city mains at 110-volt direct current. This passes through a rotary converter of 1 k.w., delivering 80 volts alternating current. The switchboard is therefore equipped with measuring instruments and switches for both direct and alternating current. The usual open circuit, hot wire ammeter is also mounted on the switchboard. The antenna switch and the circuit breaking switch



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for the rotary converter starting box are so placed that they can be operated simultaneously by a single movement of one hand. Similarly, the rotary gap switch lever has an extension handle placed directly over the key so that the same movement which starts the motor brings the hand to the transmitting key. A shunt switch throws the necessary choke coils in or out of the circuit. Oil immersed transmitting condensers are employed and in addition, protective resistance rods are placed across both the alternating current and direct current line.

Three aerials are employed, either separately or in any combination, through selective switches. It may interest some amateurs to know that the transmitting range of this apparatus extends into thirty-two counties of four states.

A conspicuous portion of the receiving set is the triple vacuum valve amplifier with loud speaker horn, as shown in the photograph, also the large coils employed in the use of the "Armstrong circuit" as well as the complete switchboard. With the triple vacuum valve amplifier, spark stations have been heard in daylight from the Atlantic to the Mississippi River, and from Canada to Cuba. With a single wire aerial 500 feet in length and a single valve hooked up according to the Armstrong circuit, continuous wave stations have been heard from Canada to the Canal Zone and from Germany to California. The signals from Arlington when employing the spark set have been copied 300 feet from the loud speaking horn, and signals from practically all stations along the Atlantic Coast in the United States have been received loud enough to copy on the typewriter, or to send many miles on the long distance telephone. Occasionally, radio telephone conversations have been heard, although their origin has not always been definitely known.

The entire equipment is mounted on a table 28 inches by 48 inches. The wall space required is only 58 inches in height from the floor by 48 inches in length. The set is not fastened to the wall in any manner, as all parts are attached directly to the table and are self-supporting, so that it could be moved without putting the set out of commission.

I shall be glad to give additional information concerning my equipment through correspondence to those who desire it.

CHRIS. M. BOWMAN, *Pennsylvania.*

## HONORARY MENTION

### Distances Covered with a 200 Meter ½ k. w. Set

We thought it would be a matter of interest to the amateur field to know the distances that can be covered with a 200 meter transmitting set of ½ k. w. power connected to an 80-foot aerial raised to a height of 50 feet above the earth.

We recently established communication with an amateur at Centerville, Cal., which is 310 miles north and near San Francisco. The owner of the receiving station employed a vacuum valve detector, but our station was not similarly supplied, as we had a galena detector only.

We also exchanged calls with an amateur at Richmond, Cal., 350 miles distant and about 10 miles north of San Francisco. He used a galena detector for receiving purposes. We have received a letter from an amateur located in Pocatello, Idaho, 700 miles distant, saying that our signals had frequently been heard there. Now and then we communicate with an amateur at San Diego, Cal., 115 miles south. These results would seem to disprove the statement often made that the amateur experimenter is limited in his work to local communication. The range northward into Idaho is especially noteworthy, when it is remembered that high mountains are believed to interfere with wireless waves.

HOWARD C. SEEFRED and LYNDON SEEFRED, *California.*

## HONORARY MENTION

### A Detector of Simple Construction That Remains in Adjustment

My experiments have led me to believe that the cat whisker receiving detector is more of an annoyance than anything else. I therefore constructed an efficient substitute.

The accompanying drawing shows the construction is very simple and

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should be understood at a glance. A piece of fibre tubing from an old fuse, about ½ inch in diameter, has placed in it two brass discs, A and B, of any thickness to fit flush in the tube. The disc, A, is inserted about ¼ of an inch from the end, after which a number of zincite particles are placed in the tube, sufficient quantity being used to take up a space of about ¼ of an inch. Place the tube in an upright position and tape it lightly so that the filings will pack closely. Then pour about an equal quantity of copper, silver and brass filings on top of the zincite and treat in the same manner, tapping the sides to pack them closely.

Next insert the disc, B. Press disc A and disc B together as tightly as possible and by means of hot sealing wax, permanently hold A and B in position. The final leads for connection to the binding posts are taken from wires soldered to A and B. As will be seen from the drawing, the entire detector takes up a very small amount of space, being no more than 1½ inches in length.

A detector of this type has been in use at my station for more than a month. I have found it exceedingly satisfactory, and it does not require continual readjustment.

PAUL A. BURVANT, JR., *Louisiana.*

## HONORARY MENTION

### Low Temperature Alloys for Crystal Mounting

The following formulae present a combination of metals which will melt at very low temperatures. A little consideration will show which of the combinations is the cheapest. Some combinations will melt at a higher temperature than it is advisable to use, but if caution is exercised in allowing the alloy to cool before mounting, no injury to the crystals will result. The following temperatures have been verified, and may be relied upon if the metals are chemically pure:

TABLE NO. 1

| | | |
|---|---|---|
| Bismuth | 8 | |
| Lead | 4 | Liquid at 212° F. |
| Tin | 4 | |

TABLE NO. 2

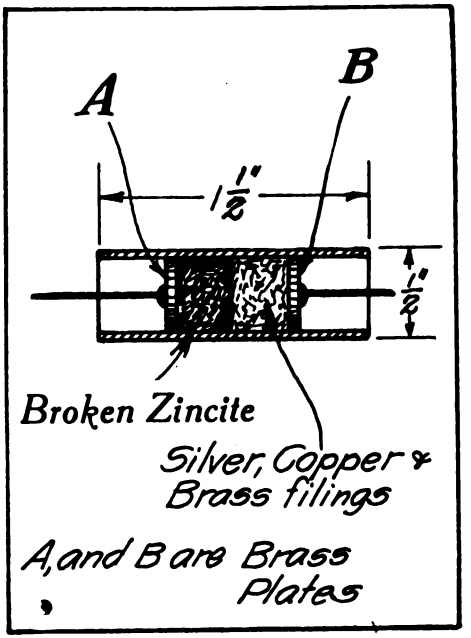
| | | |
|---|---|---|
| Bismuth | 8 | |
| Lead | 5 | Liquid at 202° F. |
| Tin | 3 | |

TABLE NO. 3

| | | |
|---|---|---|
| Bismuth | 5 | |
| Lead | 3 | Liquid at 197° F. |
| Tin | 2 | |

TABLE NO. 4

| | | |
|---|---|---|
| Mercury | 250 | |
| Bismuth | 50 | Liquid at 113° F. |
| Tin | 25 | |
| Lead | 25 | |




*Drawing, Honorary Mention Article, Paul A. Burvant, Jr.*

TABLE NO. 5

| | | |
|---|---|---|
| Lead | 26.90 | |
| Bismuth | 50 | |
| Tin | 12.78 | Liquid at 149° F. |
| Cadmium | 10.40 | |

TABLE NO. 6

| | | |
|---|---|---|
| Bismuth | 8 | |
| Lead | 6 | Liquid at 208° F. |
| Tin | 3 | |

TABLE NO. 7

| | | |
|---|---|---|
| Bismuth | 8 | |
| Lead | 8 | Liquid at 226° F. |
| Tin | 3 | |

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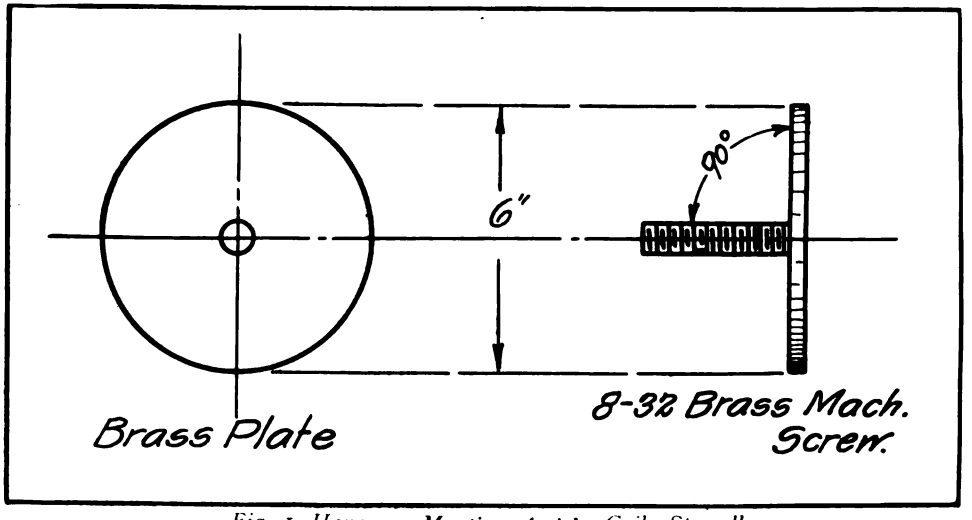


*Fig. 1, Honorary Mention Article, Gaile Stowell*

TABLE NO. 8

| | | |
|---|---|---|
| Bismuth | 2 | |
| Lead | 5 | Melts in boiling water. |
| Tin | 3 | |

O. G. FURMAN, *California.*

## HONORARY MENTION

### A Variable Condenser Which Can Be Made At Slight Cost

In the following article I shall endeavor to set forth the construction of an efficient variable condenser, which can be made at a slight cost from material found in any amateur's workshop. This type of variable condenser has a relatively small capacity, yet it is sufficient for the secondary of the average loose-coupler.

Procure a sheet of either zinc, brass, copper or aluminum, 6 by 12 inches. On this draw two circles, with a diameter of 6 inches, forming two plates. Cut these plates out and smooth the edges with a fine file. Next, solder an 8-32 brass machine-screw to one of these plates in the exact center, taking care that the axis of the screw is perpendicular to the plate. Then solder a 3-inch length of 8-32 threaded brass rod or else a 3-inch brass machine screw to the other plate, taking care that the axis of the rod is perpendicular to the plate. The plates should then appear as in Fig. 1. Next construct a case for the condenser as follows:

Prepare a base for the instrument 5 inches by 3 inches. The end pieces are 3 by 4 inches, of ¾-inch wood. Holes to pass an 8-32 screw are drilled in each end-piece, as shown in Fig. 3. Then these end-pieces are fastened to the base, as shown in Fig. 2. Next, solder an 8-32 nut to a brass strip; this strip has two holes ⅛ of an inch in diameter, drilled as shown in Fig. 3, the nut being soldered over one hole.

Now, the condenser is ready to assemble. Place the plate with the short machine-screw in one of the ends, and fasten with a nut. The plate with the longer screw is placed in the other end, and the brass strip screwed on the out-

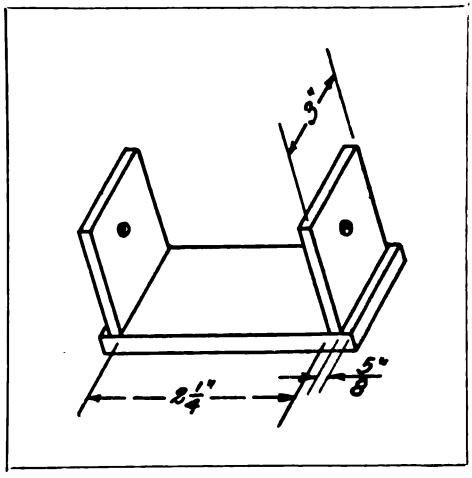


*Fig. 2, Honorary Mention Article, Gaile Stowell*

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side of the end-piece. The strip should hang downwards, and a 1/8-inch hole drilled where the other hole in the strip falls. Then an 8-32 machine-screw is placed in this hole and secured by a nut on the outside. Fasten a hard-rubber knob on the longer machine-screw, and the condenser is completed. It should then appear as in Fig. 4. Leads are taken off at the binding-posts A and B, in Fig. 4. The condenser operates as follows:

The movable plate approaches the stationary plate, thereby increasing the capacity. A narrow circular band of paper should be glued on the surface of the stationary plate to prevent the short-circuiting of the condenser. When the plates are at the maximum distance apart, the capacity is very nearly zero.

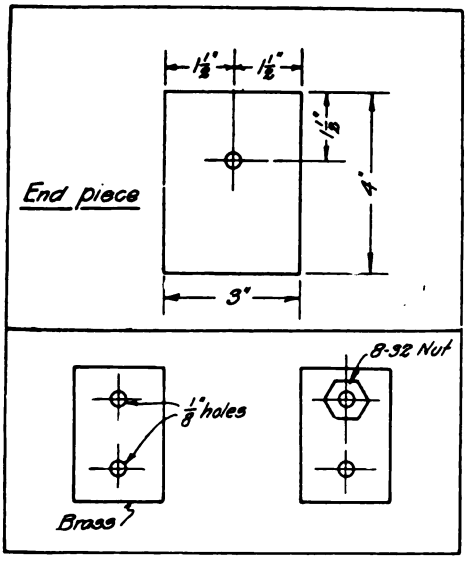


*Fig. 3, Honorary Mention Article, Gaile Stowell*

If desired, the instrument may be mounted in a case which completely encloses it, leaving only the hard-rubber handle projecting. The cost of the finished instrument should not exceed twenty-five cents, providing the work is done by the experimenter himself. The finished instrument will make a handsome and efficient addition to the set of any ameteur.

GAILE STOWELL, *Iowa.*

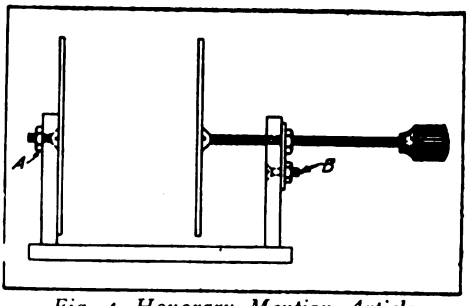


*Fig. 4, Honorary Mention Article, Gaile Stowell*

## LONG DISTANCE COMMUNICATION

I noted in the April issue of THE WIRELESS AGE an article by R. H. E. Mathews, regarding long distance transmission. While I have nothing positive to advance, I have experienced about the same results as Mr. Mathews. According to the radio list the call letters of his station are 9-IK. I have frequently heard 9-IK, 9-GJ, 9-JB, 9-KV and 9-EV. I have established direct communication with 9-PC and 8-ZW; also 8-NH. I recently received a letter from 9-JB (Winnetka, Ill.), saying that he received my signals very well. On April 9, I heard 9-PC and 1-ZL communicating with each other directly, and seemingly without any trouble whatsoever. Station 9-PC is in Fort Wayne, Ill.; 1-ZL in Northampton, Mass., and 1-CM, Laconia, N. H. These results apparently should not be considered as "freaks," as they can be obtained almost every evening.

Although I have worked 1-ZL and 1-CM, I seem to have considerable difficulty in reaching them. I have no difficulty, however, in transmitting to stations located in the western part of the United States, although I experience the greatest difficulty in transmitting northeast. I have an aerial of the inverted L type directional westward which may account for the latter difficulty. I should like to hear from the owners of other stations in regard to this last matter.

JACOB WEISS, *New York.*

---

The 135-foot spire of Trinity Church, Watertown, N. Y., is used as an aerial tower by the local Boy Scout troop.

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## Vessels Recently Equipped with Marconi Apparatus.

| Names | Owners | Call Letters |
|---|---|---|
| Oliver J. Olson | Standard Oil Co. of New Jersey. | WNB |
| Harry Luckenbach | Luckenbach Steamship Co. | KGX |
| Navahoe | R. Lawrence Smith, Inc. | KOR |
| Freshfield | R. Lawrence Smith, Inc. | VEZ |
| Starlite | Standard Oil Co. of New Jersey. | KPK |
| Moonlite | Standard Oil Co. of New Jersey. | KPL |
| Twilite | Standard Oil Co. of New Jersey. | KPO |
| Dawnlite | Standard Oil Co. of New Jersey. | KPP |
| Sunlite | Standard Oil Co. of New Jersey. | KPQ |
| Daylite | Standard Oil Co. of New Jersey. | KPR |
| Barge The Limit | Whitney Bros. Co. | WCV |
| Munplace | Munson Steamship Line. | KUG |
| Munsomo | Munson Steamship Line. | KUK |
| Republic | John A. Hooper. | (Not assigned) |
| Campana | Standard Oil Co. of New Jersey. | KOM |
| Nebraskan | Garland Steamship Corporation. | WKY |
| Tug Vigilant | Moore & McCormick Co., Inc. | (Not assigned) |

## THE SHARE MARKET

NEW YORK, May 10.

Except for the securities of the Canadian company which have received strong support from buyers in the Dominion, Marconi shares have for the past month remained quiet and steady in a dull market. Owing to the provision of the English act against trading with the enemy, no stocks not held in Great Britain prior to September 1, 1914, can be sold on a British exchange. On account of this limitation of the market, American prices on English shares have ruled lower than the quotations in London. On the New York Curb, the activity in shipping, sugar and metal shares have drawn speculative interest away from other classes of stocks. Within the past week, both interest and prices have shown improvement.

Bid and asked quotations today: American, 3¼-3½; Canadian, 2-2½; English, common, 10-10½; English, preferred, 8½-11.

## MAKING PROGRESS AT MARE ISLAND

The construction of the 300-foot towers for the new long distance wireless station at Mare Island, near San Francisco, Cal., is under way. When the 30 k.w. apparatus is installed Mare Island will be in constant communication with ships of the American navy along the coast as far as the southern boundary of Mexico. In addition, navy officers will be able to communicate directly with any station on the Pacific and the Government station at Arlington.

## EASIER TO SEND BY DAY THAN AT NIGHT

The wireless service men with the American punitive expedition into Mexico, it is related, were surprised to discover that conditions in that country were exactly the reverse of those in the United States. In the United States the wireless operators find that the night time is much better for the transmission of dispatches. South of the border the day time is best.

There is so much atmospheric disturbance at night in Mexico that wireless men prefer the day as a time for operating. This is not due to the altitude, which is 7,000 feet, but to the minerals in the mountains, especially iron ore.

Guglielmo Marconi was forty-two years old on April 25.

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# National Amateur Wireless Association

## OFFICERS OF THE ASSOCIATION.

PRESIDENT, Guglielmo Marconi.

NATIONAL ADVISORY BOARD OF VICE PRESIDENTS

Professor A. E. Kennelly,
Harvard University.
President, Institute of Radio Engineers.

Professor Samuel Sheldon,
Polytechnic Institute of Brooklyn.

Professor Alfred N. Goldsmith
College of the City of New York.

Professor Charles R. Cross,
Massachusetts Institute of Technology.

Hiram Percy Maxim,
President, American Radio Relay League.

Major William H. Elliott,
Adjutant General, Junior American Guard.

Capt. W. H. G. Bullard, U. S. N. Superintendent, U. S. Naval Radio Service.

Lieut.-Col. Samuel Reber, Signal Officer, U. S. Army.

E. E. Bucher, Instructing Engineer, Marconi Wireless Telegraph Company.

ADMINISTRATIVE OFFICERS:

ACTING PRESIDENT,
J. Andrew White,
Editor, THE WIRELESS AGE.

MANAGING SECRETARY,
Clayton E. Clayton,
450 4th Avenue, New York.

A national organization of wireless amateurs was announced in the October, 1915, number of THE WIRELESS AGE. Further details of the organization are given in an address made by J. Andrew White, which was published in the November WIRELESS AGE. Reprint copies sent upon request.

## MEMBERS' EQUIPMENT.

**1st. CERTIFICATE OF MEMBERSHIP.**

The handsomely steel-engraved Certificate, with shadow background half-tone, is sealed and signed by Officers, with the endorsement of Senatore Marconi, as President. Every member will want to frame and place it alongside of his Government License certificate, two documents establishing status as wireless amateurs.

**2nd. AERIAL PENNANT.**

The 36 inch aerial pennant, painted in four colors on scarlet felt, will stand long service at your aerial mast head. Every member will be proud of the National Insignia flying from his aerial.

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**3rd. MEMBERSHIP PIN.**

**The National Amateur Wireless Association Pin in gold and enamel is the National emblem of the Association. The design shown on the preceding page can but faintly describe its handsome appearance in three colors and gold. The pin has a special patented hub and shank which permits it being securely fastened on the coat lapel or on the vest without turning upside down.**

**4th. LIST OF RADIO STATIONS OF THE WORLD.**

**Revised Edition just published. See advertisement. Regular 50c edition.**

**5th. HOW TO PASS U. S. GOVERNMENT WIRELESS LICENSE EXAMINATIONS.**

**Regular 50c edition of this popular book. Members who already have a copy, see concessions below.**

**6th. HOW TO CONDUCT A RADIO CLUB.**

**This splendid book, which has been months in preparation and incorporates portions of articles running under the same title in THE WIRELESS AGE, is re-written to cover every new development, and with a large proportion of new matter. It is the foundation stone of the National Amateur Wireless Association activities. Price of this book 50c.**

**7th. MONTHLY BULLETIN SERVICE.**

**It is intended to make the monthly bulletin service for members of the National Amateur Wireless Association one of the most important features of the Association. This bulletin is to be used in connection with "List of Radio Stations of the World" described above. It will carry all additions (both amateur and commercial) to "List of Radio Stations of the U. S.", issued by the Bureau of Navigation, U. S. Department of Commerce, and secured for members at 18c a copy. The Government list is issued only once a year. The Association Bulletin will keep both lists up to date for you month by month, and in addition, will carry other special and invaluable Association features not obtainable elsewhere**

**8th. ONE YEAR'S SUBSCRIPTION TO THE WIRELESS AGE.**

**THE WIRELESS AGE is the Official Organ of the National Amateur Wireless Association and will contain full reports of wireless amateur activities, both national and local. It is planned to give published recognition to individual amateur achievement.**

## CONCESSIONS:

Those who, *during the past six months,* have become subscribers to THE WIRELESS AGE, or have renewed their subscription, or have purchased any portion of the Membership Equipment, may consider such payment as partial payment of Membership Application as given below. If you have paid for a subscription to THE WIRELESS AGE which includes books which are not a part of the Membership Equipment, then you may credit $1.25 of the remittance as partial payment on the Membership. For example, you may have remitted $2.25 for the combination offer of the 1915 Year Book with one year's subscription to THE WIRELESS AGE. In this combination, the price of both the book and the subscription was reduced, to make the special offer; therefore, you may be credited only with that part of the payment which went to the magazine—that is, $1.25. *Coupon subscribers receive no credit for trial orders.* Subscribers to THE WIRELESS AGE who *began or renewed more than six months ago,* will secure through Membership dues a renewal for another year; and their subscriptions will be extended for one year from the time the present subscription expires.

## INITIATION FEE

An initiation fee of $1.00 is required of all new members to pay for the initial membership equipment, consisting of Nos. 1, 2, 3, 4, and 5.

## ANNUAL DUES

The annual dues are to be not more than $2.00. For this, all members are to receive:

1st. The Monthly Bulletin Service.

2nd. THE WIRELESS AGE for one year.

3rd. How to Conduct a Radio Club or equivalent.

4th. 10% discount on any book on wireless published, and other features to be announced later.

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**SPECIAL NOTICE REGARDING CORRESPONDENCE.**

**As the National Amateur Wireless Association is in no sense a money making enterprise, and as the nominal dues will cover a very small amount of handling expense, it is desired that the correspondence be limited to only the most essential necessities.** A cordial invitation is extended to all club officials to write on matters pertaining to organization. This invitation also includes those who are interested in starting new clubs.

**Charters** Out of the amount paid by each member for annual dues, it is purposed to allow organizations that have become part of the National Amateur Wireless Association a rebate of 50 cents out of each $3.00 for their own treasury—a fund to take care of local expenses. Please note that this is a rebate, not a deduction. In order to qualify for recognition as a unit in the National Amateur Wireless Association, a club must have at least five active members and at least one-quarter of its total membership become members of the National Amateur Wireless Association. Clubs securing a charter will have representation in the National Council; this means that they elect their own delegate and thus secure a voice in the management of the Association and in the planning of its future development and activities.

**Clayton E. Clayton, Managing Secretary,**
**450 4th Ave., New York.**

**Checks and money orders should be made payable to: Natl. Amateur Wireless Assn.**

## APPLICATION FOR MEMBERSHIP.

CLAYTON E. CLAYTON, Managing Secretary,

NATIONAL AMATEUR WIRELESS ASSOCIATION, Date.....

450 4th Avenue, New York City.

As I desire to receive full recognition as an amateur wireless worker of the United States, I ask the privilege of enrollment as a Member in the National Amateur Wireless Association and request that you send me the complete Members' Equipment for which I enclose herewith remittance of $1.00 Initiation Fee, covering Initial Equipment, and $2.00 for First Annual Dues—or $3.00 in all. Option.*

I trust that you will act upon my application promptly and forward the equipment to me at the earliest possible date.

My qualifications for membership are given in blank spaces below.

Signature ..... Age.....

Street Address .....

Town and State.....

Please credit me with $..... paid for.....

* Option.

In the event that an applicant is unable to send the entire amount of the membership dues with this application, the figure $3.00 may be crossed out and $1.00 written in its place. This will be considered an agreement on the part of the applicant accepted for Membership that the balance of dues ($2.00) will be paid at the rate of 50c per month for the next four months, at which time pin, pennant and Certificate of Membership will be issued. The other equipment will be sent at once.

## FILL IN ANSWERS TO THESE QUESTIONS.

1—Have you a Government License (give number.....) or do you purpose applying for one?.....

2—If you are under 21 years of age, give names of two adults for references as to character.

Reference.....

Reference.....

3—If you are a member of any Local, State or Interstate wireless club or association, give its name, and name of Secretary with address.

.....

4—Are you now a subscriber to THE WIRELESS AGE?.....

5—If you already have any books included in the equipment, state which ones.....

.....

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# National Amateur Wireless Association

A DIRECTING ORGANIZATION DEDICATED TO THE PROMOTION OF RADIO COMMUNICATION

CALL LETTERS 9PY
S. W. PIERSON
CARROLLTON, ILLINOIS

GUGLIELMO MARCONI, PRESIDENT

Reduced fac-simile of letter head.

## For Clubs and Members of National Amateur Wireless Association

The following list of items of optional equipment is listed at cost price in order to give members and clubs of the Association every material advantage in the way of a complete equipment that may be desired. Prices include transportation charges to 5th Parcels Post Zone. Postage extra to 6th, 7th and 8th Zones.

**LETTER HEADS AND ENVELOPES:**

100 National Association Letter heads with imprint of member at left hand side, as illustrated above 75c
Without member's imprint..... 35c
100 Envelopes with imprint..... 65c
*Special prices on 1000 Letter Heads to Clubs.*

**MESSAGE BLANKS:**

Pads of 50..... 10c

**STATION LOG BOOK:**

A record book in which to keep track of all your operations and communications, in paper..... 15c
in cloth ..... 30c

**RADIO STATIONS OF THE U. S.:**

Call list issued by the U. S. Department of Commerce, postpaid.. 18c

**PHOTOGRAPHS AND PICTURES:**

Photographs of important stations, such as Belmar, Arlington, Sayville, Honolulu, etc., 9" x 12", each ..... $1.00

Duotone picture of G. Marconi, with facsimile signature, suitable for framing ..... 25c

**SOLID GOLD BUTTONS, 14 Karat** N. A. W. A. emblem..... $1.75

**WIRELESS MAP OF THE WORLD** in colors ..... 50c

**YEAR BOOK OF WIRELESS TELEGRAPHY AND TELEPHONY,** published at $1.50, special to members and clubs ..... $1.10

**CLUB PENNANTS:** Made of first quality wool bunting, letters and emblem sewed on with cut outs in color and name of club added, prices on application.

Extra pennants for members 30c each

Fac-simile of 36 inch Pennant.

Send all orders to Clayton E. Clayton, Managing Secretary, National Amateur Wireless Association, 450 Fourth Ave., N. Y. City.

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# Queries Answered

Answers will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all letters and only one side of the paper written on; where diagrams are necessary they must be on a separate sheet and drawn with India ink. Not more than five questions of an individual can be answered. To receive attention these rules must be rigidly observed.

**Positively no Questions Answered by Mail.**

G. K., Vincennes, Ind.:

You should purchase a text book covering the fundamentals of amateur wireless telegraph apparatus and familiarize yourself with the underlying principles. The book "How to Conduct a Radio Club" is recommended for the solution of your problems. The aerial, 30 feet in length by 20 feet in height, has a natural wave-length of approximately 80 meters; with it you can expect a small sending or receiving range. With the ½-inch spark coil as the source of power, you should be able to transmit a distance of one or two miles. The receiving equipment you describe should allow communication with local amateurs, but it is rather doubtful whether you will be able to hear signals at a great distance.

For continuous and uninterrupted service, an alternating current transformer is superior to a spark coil. To communicate one or two miles, a 1-inch or 2-inch spark coil fulfills the requirements. Many amateur stations are able, with a 2-inch spark coil, to communicate thirty miles.

* * *

J. C. M., Larchmount, Norfolk, Va., inquires:

Ques.—(1) Please give me data concerning the natural wave-length of an aerial consisting of four wires, with the usual spacing, 51 feet in length and 40 feet in height.

Ans.—(1) The fundamental wave-length of this aerial is approximately 165 meters. The inductance value is approximately 40,000 centimeters and the capacitance about .0002 microfarad.

Ques.—(2) Please give the possible wave-length adjustment with a receiving transformer connected to this aerial, the transformer having the following dimensions: The primary winding is 4 inches in length, 3½ inches in diameter, wound with No. 30 single cotton-covered wire; the secondary winding is 3½ inches in length, 3 inches in diameter, wound with No. 36 single silk-covered wire.

The additional equipment comprises a perikon detector, a Mesco variable condenser with a capacity of .001 microfarad and a pair of Brandes superior 2,000-ohm telephones.

Ans.—(2) The primary winding will raise the wave-length of the antenna described in the first query to about 1,500 meters.

The secondary winding shunted condenser of .0001 microfarad will respond to a wave-length of 2,000 meters, but with the capacitance of .001 microfarad in shunt will afford a wave-length adjustment of about 5,000 meters. You will observe that, in order to keep the antenna circuit in resonance with the secondary winding at the longer range of wave-lengths, a loading coil of considerable proportions is required.

Ques.—(3) Basing your answer upon the diagram of connections accompanying my query for the Marconi Type D tuner, approximately to what range of wave-lengths would my receiving apparatus tune?

Ans.—(3) Your diagram of connections is incorrect. The fixed stopping condenser should be connected in series with the lead from one of the sliders to a terminal of the detector. The potentiometer and head telephones may either be shunted about the fixed stopping condenser or placed around the crystal detector. With the circuit thus corrected the Type D tuner should permit response to wave-lengths (with the aerial referred to in the first query) up to 3,000 meters.

* * *

R. F., Jr., Rosebank Post Office, Grasmere, N. Y., inquires:

Ques.—(1) Please state the natural period of an aerial, 65 feet in length, 35 feet in height, with a lead-in 40 feet in length. It comprises four wires, spaced 2 feet 5 inches apart.

Ans.—(1) The fundamental wave-length is approximately 168 meters.

Ques.—(2) What would be the natural wave-length of the same aerial with the lead-ins attached to the center, the latter being 20 feet in length.

Ans.—(2) In this case the fundamental wave-length would be between 90 and 100 meters.

Ques.—(3) Which of the two aerials described will be the less directive?

Ans.—(3) The antenna of the T type.

Ques.—(4) Regarding wave-length, which aerial is the better for operation at the wave-length of 200 meters?



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Ans.—(4) The first described aerial will give the best results, as the dimensions are well within the limits for operation at the wave-length of 200 meters.

* * *

H. F. W., Montpelier, Vt., inquires:

Ques.—(1) Will you kindly explain why the buzzer circuit of the receiving set, described in the October, 1915, issue of THE WIRELESS AGE, is connected to the potentiometer battery circuit?

Ans.—(1) In the later sets of this type the buzzer testing circuit has been completely disconnected from the potentiometer battery circuit and connected to independent binding posts. Crystals of carborundum often give better response from a buzzer testing circuit when one terminal of the buzzer tester is attached directly to some portion of the circuit.

Ques.—(2) What are the requirements of any potentiometer battery in the matter of voltage and amperage?

Ans.—(2) For crystalline detectors, the maximum value of potential need not exceed four volts. The current output of the battery in any receiving set is unimportant, because these detectors generally require only a very small fraction of an ampere.

Ques.—(3) How is provision made in receiving sets for a variation of the ratio of the capacity to the inductance of the circuit in order to maintain the same wave-length?

Ans.—(3) For the antenna circuit this is accomplished by connecting a variable condenser in series with the earth lead. By proper selection of capacity at the condenser and corresponding inductance value at the aerial tuning inductance, or at the primary winding of the receiving oscillation transformer, the wave-length of the circuit can, with a change of decrement, be maintained. There are limits, with a given antenna system, over which this variation may be carried. To have a particularly noticeable effect upon the wave-length of the antenna system, the maximum capacity of the variable condenser must be somewhat near that of the antenna itself, because when two condensers are connected in series the resultant capacity is nearer to that of the smaller one; consequently a condenser of large capacity has but little effect upon an antenna of small capacity. At the secondary winding of the receiving tuner, the desired ratio of inductance to capacity is obtained at the multiple point switch connected to the secondary winding and at the variable condenser connected in shunt to this winding. For the best strength of signals the capacity of the condenser in the secondary winding must be kept at a low value; at the most it should not exceed .001 microfarad and it is more usual to employ a capacitance of about .0005 microfarad.

Ques.—(4) On what wave-lengths do Arlington and Sayville transmit when employing the undamped oscillation transmitter?

Ans.—(4) The wave-length of Arlington is between 6,000 and 7,000 meters; the wave-length of Sayville is about 9,000 meters.

Ques.—(5) Please give the approximate dimensions for the construction of a condenser to have a capacity of .04 microfarad. The dielectric is to be extra thin paraffin tissue paper.

Ans.—(5) One surface of the condenser should have approximately 1,200 square inches of foil. Knowing the dimensions, you can rearrange the construction of the condenser to suit the design of your receiving set. For example: it may be made up of a number of small sheets of tinfoil, say, 3 inches by 6 inches, with a sufficient number of sheets connected in parallel on one side of the condenser to represent a total area of 1,200 square inches.

* * *

W. O. S., Ithaca, N. Y., inquires:

Ques.—(1) Please tell me the wave-lengths and the capacity in microfarads, of the following aerials:

Aerial No. 1 is 100 feet in length, 30 feet in height, with a 50-foot lead-in, and is of No. 14 wire throughout. Aerial No. 2 has two wires, 360 feet in length, 80 feet in height, with two 50-foot lead-ins. This aerial has seven strands of No. 22 wire, with a lead-in of No. 12 wire.

Ans.—(1) The fundamental wave-length of the first described aerial is approximately 237 meters and the total capacitance about .00035 microfarad. The fundamental wave-length of the second aerial is approximately 560 meters and the capacitance about .00128 microfarad.

Ques.—(2) Please give a formula for the capacity of two parallel wires.

Ans.—(2) The following formula is applicable:

$$C = \frac{L}{4 \times 9 \times 10^5 \times 2.3026 \log_{10} \frac{2D}{d}}$$

where C = the capacity in microfarads;
L = the length of the wire in centimeters;
d = the diameter of the wire in centimeters;
D = the distance apart of the axes in centimeters.

* * *

M. H. P., Lansing, Mich., inquires:

Ques.—(1) In the beat receiver diagram, described on page 82 of the book "How to Conduct a Radio Club," what is the function of coils L-5 and L-6? What part do coils L-6, L-7, L-11 and L-12, shown in the February Monthly Service Bulletin of the National Amateur Wireless Association, play in the operation of the apparatus?

Ans.—(1) The coupling transformer L-5 and L-6, is used for impressing oscillations of the wing circuit upon the grid circuit of the vacuum valve; this is said to result in an increase of the amplitude. Similar functions are performed by the coils L-6 and L-7, L-11 and L-12, in the diagram published in the Bulle-

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tin. The complete circuits are known as regenerative circuits. The undamped oscillations which flow in the wing circuit are passed to the grid circuit, causing a periodic variation of the current in the wing circuit, which results in increased amplitude of oscillation.

Ques.—(2) Would the diagram shown in "How to Conduct a Radio Club" be as effective as that shown in the February Bulletin, if the second valve indicated in the Bulletin article were used as an amplifier for the apparatus described in the book?

Ans.—(2) An amplification of the signals will be obtained by adding the second valve to the circuit indicated on page 82 of the book, but it is quite probable that better signals will be received by the method indicated in the Bulletin. As therein stated, the great advantage of that circuit lies in the fact that the amplitude of the oscillations supplied from the local generator to the antenna circuit can be very carefully regulated by means of the coupling coil L-4, L-3. Both circuits are applicable to the reception of damped and undamped oscillations.

Ques.—(3) In both of these articles No. 28 single silk covered wire is recommended for the coils of inductance. What latitude on either side might be used and still maintain the same efficiency, the inductance value being kept about the same?

Ans.—(3) Certain experimenters report good results with loading coils for the wing and grid circuit made up of No. 36 single silk covered wire. It is not advisable, in our opinion, to go below No. 26. With No. 36 wire the dimensions of coils, of course, can be considerably less.

Ques.—(4) By placing a vacuum valve in a state of oscillation, is the internal action in any way injurious to the bulb, so that its working as an ordinary detector is impaired? And do all types of vacuum valves work satisfactorily in such circuits?

Ans.—(4) If the vacuum valve is one of the type in which considerable gas is present and the valve is worked beyond the point of ionization (blue glow) the filament is apt to disintegrate rather rapidly. If, however, the circuits described on page 82 of the book "How to Conduct a Radio Club" are used and the coils designed after the dimensions given, it is possible to set the valve in a state of oscillation below the characteristic blue glow point. Hence it will work as well in an ordinary circuit as when set into oscillation. Identical results are not obtained from all valves; it is found difficult to keep some of them in a stable state of oscillation; in fact, equal results cannot be obtained from two separate filaments in the same bulb.

Ans.—(5) A complete disquisition on the working of the vacuum valve under all conditions of oscillation is published in the proceedings of the Institute of Radio Engineers for September, 1915. Copies of the proceedings can be obtained from the Secretary, No. 111 Broadway, New York City. The price in the United States is $1 a copy.

J. S. G., Scranton, Pa.:

Ques.—(1) Please give the dimensions for a buzzer that will send about two miles.

Ans.—(1) The dimensions for a buzzer of this type are not necessary. Any of the small buzzers procurable in the amateur market will serve the purpose. Distances of several miles are only possible when an extremely sensitive receiving set is employed at the receiving station.

Ques.—(2) I should like to construct a condenser of .01 microfarad capacity, to be used with this buzzer. What are the correct dimensions for the foil?

Ans.—(2) The condenser should have approximately 300 square inches of foil. You may arrange the design to suit conditions. It may be made up of a number of small sheets, connected in parallel.

Ans.—(3) A complete circuit for amplifying the signals of a crystalline detector by means of a vacuum valve is published in the book "How to Conduct a Radio Club."

* * *

C. J. P., New York City:

The natural wave-length of a given aerial system is the same for either transmitting or receiving purposes. If the receiving tuner you describe actually has a possible wave-length adjustment of 3,000 meters, you certainly should be able to hear the signals from Arlington on an aerial 175 feet in length by 80 feet in height. Lacking the dimensions of the tuner, it is difficult to give proper advice, but if you will duplicate the coils and the diagram of connections appearing in the Monthly Service Bulletin of the National Amateur Wireless Association, for January, 1916, you will have a receiving equipment that will give very loud signals from Arlington in New York City. The tuning coils described are applicable to crystalline detectors as well as to the vacuum valve, with the exception that the capacity of the grid condenser C-2 must be considerably increased. It may have a value varying from .003 to .04 microfarad. The diagram of connections accompanying your query is quite correct, with the exception that it shows no variable contacts on the primary and secondary windings. For crystalline detectors, we prefer a secondary winding of No. 32 single silk covered wire.

* * *

A. T. R., Columbus, Ohio:

Ques.—(1) Regarding the rotary quenched spark gap, described in the February issue of THE WIRELESS AGE by Mr. Heninger: What should be the separation between the electrodes of the gap?

Ans.—(1) The electrodes should be separated by no more than 1/100th of an inch.

Ques.—(2) What is the capacity in watts of this set?

Ans.—(2) Between ¼ and ½ k.w. Please observe that the condenser capacity of this set is .02 microfarad, which is an excessive value for operation at the wave-length of 200 meters. The maximum value of capacity that can be employed for a wave-length of 200 meters is

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.01 microfarad. The value is preferably .008 microfarad to allow for longer connecting leads to the various parts of the equipment.

* * *

L. L. H., Albany, Ore., inquires:

Ques.—(1) Please state the natural wave-length of this aerial: The flat top portion consists of two wires spaced 9 feet apart and the lead-in is taken off the high end. The flat top is 475 feet in length, 75 feet in height at one end and 35 feet at the other. The length of the lead-in is 100 feet.

Ans.—(1) The fundamental wave-length of this aerial is about 750 meters.

Ques.—(2) Please give the capacity in microfarads of the aerial referred to.

Ans.—(2) Approximately .00149 microfarad.

Ques.—(3) Where can I obtain a book giving the dimensions of standard bare copper wire, single and double cotton wire, also single and double silk covered wire?

Ans.—(3) Secure a copy of Foster's "Electrical Engineers' Pocketbook." The price is $5 a copy. Communicate with the Marconi Publishing Corporation, No. 450 Fourth Avenue, New York, for further particulars.

Your fourth query cannot be answered because the fundamental wave-length of your aerial is already in excess of 600 meters; therefore we could not give you the correct number of turns for the primary winding of the transformer, or the exact location of a dead end switch because you now require a short wave condenser. It is difficult to state the exact number of turns for a given secondary winding unless we are fully informed as to the maximum and minimum values of capacity for the condenser in shunt to that winding. You are advised to construct a wave-meter like that described in the Radio Club article in the March, 1916, issue of THE WIRELESS AGE. By placing this meter in inductive relation to the antenna system and exciting it with a buzzer you can preadjust your tuning coil to a distinct wave-length by experiment.

Regarding your query in reference to the calculation of inductance, in the article appearing in the August, 1915, issue of THE WIRELESS AGE: You are quite correct in your assumption. In the case of bare wire for the correction factor, D is taken as the spacing between turns and the ratio of $\frac{d}{D}$ is the ratio of the diameter of the bare wire to the space taken up between turns.

* * *

J. E. R., Albany, N. Y., inquires:

Ques.—(1) Please give me the necessary data for a closed core transformer of ¾ k.w. capacity to be operated at 110 volts 40-cycle alternating current. The secondary voltage is to be in the neighborhood of 12,000 volts.

Ans.—(1) We assume that you are already familiar with the laying out and assembly of the laminations for the core. If not, you should familiarize yourself with articles in the amateur department of THE WIRELESS AGE, where, in previous issues, the subject has been covered. These data are applicable. The outside measurements of the core are as follows: Length, 9½ inches; width, 7½ inches; thickness of the core, 1¾ inches. The primary winding is made upon one leg of the core and the secondary on the opposite leg. The primary winding consists of fourteen layers of No. 14 double cotton covered wire for which about six or six and one-half pounds are required. The secondary winding contains ten pounds of No. 34 enamelled wire made up in sections ¼ of an inch in thickness with an outside diameter of about 5½ inches. The inside diameter is approximately 2¾ inches. The secondary sections should be separated by insulating discs having a thickness of ⅛ of an inch. The primary and secondary windings may be insulated from the core by means of empire cloth at least ¼ of an inch in thickness.

Ques.—(2) Please tell me the receiving range and possible wave-length adjustment of the following equipment: The antenna has six wires 75 feet in length with an average height of 40 feet. The receiving tuner has a primary winding 4½ inches in diameter, 6 inches in length, wound with 210 turns of No. 26 enamelled wire. The secondary winding is 6 inches in length by 3¾ inches in diameter, wound with No. 30 enamelled wire. The apparatus also includes a galena detector, a variable condenser across the primary winding and a pair of 3,000-ohm head telephones.

Ans.—(2) The fundamental wave-length of the antenna system is approximately 220 meters and with the primary winding described will permit adjustment in that circuit to a wave-length of about 1,550 meters. A similar value of wave-length is readily obtained in the secondary winding. During the night time you should hear commercial stations located on the Atlantic coast. You require a loading coil in series with the primary winding to hear the time signals from Arlington, however.

* * *

R. B., Toledo, Ohio, inquires:

Ques—(1) What is the address and the cost a year of the Philosophical Magazine?

Ans.—(1) The annual subscription price is $9.00. Send your remittance to Taylor & Francis, 7½ Red Lion Court, Fleet Street, E. C., London, England.

Ques.—(2) Can the Proceedings of the Radio Institute be purchased by non-members? If so, what is the cost?

Ans.—(2) Copies of the Proceedings are sold to non-members for $1 each. Send your remittance to the Secretary, 111 Broadway, New York City.

Ques.—(3) What is the subscription price a year of Science Abstracts? Where can copies be purchased?

Ans.—(3) The New York agents for this publication are Spon & Chamberlain, No. 123 Liberty Street, New York City. This journal is divided into two sections; section A is devoted to physics; section B to engineering. The annual subscription price of a single section is $4.50 and for both sections $7.50. The price of a single copy is 40c.

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J. C. McG., Wollaston, Mass., inquires:

Ques.—(1) Please give the approximate values of the capacity and inductance of wave-length of the following three single wire aerials: Aerial No. 1 is 135 feet in height; aerial No. 2, 155 feet in height, and aerial No. 3, 175 feet in height. The lead-in to each aerial is approximately 50 feet in length. The ground lead is 70 feet.

Ans.—(1) Aerial No. 1 has an approximate wave-length of 275 meters, a capacitance of .00033 microfarad and an inductance of 64,630 centimeters. Aerial No. 2 has a fundamental wave-length of 300 meters, a capacitance of approximately .000369 microfarad and an inductance value of 68,700 centimeters. Aerial No. 3 has a fundamental wave-length of 332 meters, a capacitance of .0004 microfarad and an inductance of about 77,580 centimeters.

To give the dimensions for a receiving tuner for a definite range of wave-length, as in your second query, we should have to know the inductance and capacity value of the particular aerial with which this is to be employed. For adjustment to a wave-length of 1,500 meters, the secondary winding of the receiving tuner may be 3½ inches in length by 3 inches in diameter, wound full with No. 30 single silk covered wire. A small variable condenser is, of course, connected in shunt with the secondary winding. The dimensions of the primary winding will vary with the size of the aerial. With the ordinary run of amateur aerials the primary winding may be 4 inches in length by 3½ inches in diameter, wound with No. 26 single silk covered wire. For crystalline detectors No. 32 wire is often preferred; hence the dimensions of the secondary winding in respect to length may be slightly decreased.

For 200-meter work an aerial of the inverted L type cannot exceed 50 feet in length for the flat top portion. One of the T type may be from 110 to 120 feet in length. The height from the earth should not exceed 50 feet with these dimensions.

* * *

J. J. C., Brooklyn, N. Y., inquires:

Ques.—(1) What is the fundamental wave-length of a three-wire aerial 85 feet in length, 35 feet in height? It is of the inverted L type.

Ans.—(1) The fundamental wave-length is approximately 210 meters.

Ques.—(2) Please give the dimensions for a loose coupler to be used in connection with a tikker detector for the reception of undamped oscillations from Sayville and other stations.

Ans.—(2) The secondary winding should be made up on a card board or hard rubber tube 6 inches in diameter, 14 inches in length, wound full with No. 24 single silk covered wire. This winding should be shunted by a condenser of .001 microfarad capacity. The condenser in shunt with the head telephone should be one of rather large capacity, approximately .05 microfarad. Condensers of even larger capacity have been effectively employed across the telephone circuit. We do not know the dimensions of the aerial with which this apparatus is to be employed, but the primary winding of the oscillation transformer may be 14 inches in length, 7 inches in diameter, wound closely with No. 22 single silk covered wire. If for use with your present small aerial the loading coil should be 36 inches in length, 7 inches in diameter, wound closely with No. 22 single silk covered wire. A loading coil of decreased dimensions can be employed if a variable condenser is shunted from the antenna to the earth. If your receiving station is already supplied with a variable condenser it will be cheaper to connect the apparatus in this manner, than to construct a loading coil.

* * *

L. B., Wildwood, N. J.:

A 4-wire aerial, 50 feet in length by 50 feet in height, of the inverted L type, has a fundamental wave-length of approximately 177 meters, which is quite the proper value for the transmission and reception on the 200-meter restricted wave.

Your receiving apparatus is probably adjustable to wave-lengths of 2,500 meters, particularly if the capacity of the condenser in shunt to the secondary winding is about .001 microfarad.

The station at Sayville operates at a wave-length of about 9,000 meters. An undamped oscillation generator is employed. The Marconi station at Cape Cod operates on press schedule, each evening, at fifteen minutes after ten o'clock, with a wave-length of 2,100 meters. The station is also fitted with a small transmitting set which operates at wave-lengths of 300 and 600 meters. The small set at Key West, Fla., for commercial correspondence, operates at a wave-length of 600 meters. This station is also fitted with a 25 k.w. spark set and 30 k.w. arc set, the latter using a wave-length of approximately 6,000 meters. The station at Darien, Isthmus of Panama, operates at a wave-length of approximately 7,000 meters and the signals are audible in New York City during the daytime with a supersensitive receiving set.

The Packard 500-watt 13,000 volt transformer, which we assume is to be operated on the 200-meter wave, should give you a daylight range of from thirty to forty miles and a considerably greater night range, depending on the type of apparatus used at the receiving station.

* * *

J. C., Rankin, Pa.:

The editor of this department has expressed his opinion in previous issues, concerning the range of wave-lengths to be obtained from the coils of a tuner. It is first necessary for us to know the maximum and minimum values of capacity of the condenser connected in shunt to the secondary winding. In addition we cannot estimate the range of the primary winding, unless information concerning the inductance and capacity of the aerial system with which it is to be employed is supplied. Roughly speaking, a secondary winding, 4⅛ inches in diameter by 6 inches in length, wound with No. 32 double cotton covered wire, should

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be responsive with a small condenser in shunt to wave-lengths of approximately 3,000 meters. No. 38 single silk covered wire is too small for receiving tuners. The resistance is detrimental to the flow of energy.

A loading coil, 2 feet in length, 6¼ inches in diameter, wound closely with No. 20 enamelled wire, will raise the average amateur aerial to a wave-length of about 6,000 or 7,000 meters.

The design of a 1 k.w. open core transformer is given in the book "How to Conduct a Radio Club." It is preferable to vary the power input to this transformer by an external reactance, which is easy to construct. Wind this coil with the same size wire used on the primary winding of the transformer proper. The aerial shown in your diagram is similar to that employed at the average station, and the indicated disposition of the lead-ins will not interfere with the reception of signals. We have stated many times in the columns of this department that a super-sensitive receiving set is required for reception of signals from Nova Scotia. It will be found extremely difficult to pick up these signals with receiving apparatus fitted with an ordinary crystalline detector.

* * *

L. H. M., Skagway, Alaska:

Mechanical interrupters have not proven to be as efficient as the ordinary hammer break fitted to the usual induction coil. The interrupter shown in your drawing should be shunted by a condenser having at least 8,000 square inches of tinfoil, separated by a thin sheet of paraffin paper. We have no additional advice to offer, but believe you will soon discover that the life of the contacts on your interrupter is limited.

* * *

R. M., San Francisco, Cal.:

The appearance of an ether wave, as set up by a transmitting aerial, is depicted on pages 106 and 107 of the "Text Book on Wireless Telegraphy," by Rupert Stanley. The subject is described in the book "Wireless Telegraphy and Telephony," by A. E. Kennelly. For each cycle of current in a wireless telegraph aerial, there is set up two distinct sets of electric loops or strains, with their forces acting in opposite directions. The greatest distance between two points in a succession of waves at which the strain is at a maximum and in the same direction is the wave-length of the emitted energy.

* * *

E. B. D., Baltimore, Md.:

The results you have obtained with Poulsen tikkers are of interest. A reconstructed receiving tuner is advised in connection with the Armstrong circuit, as described in the "Proceedings of the Institute of Radio Engineers." A secondary winding of No. 32 wire is better for the vacuum valve detector, while the primary winding may be of No. 24 or No. 26 wire.

If you desire to receive strong signals from undamped transmitters, construct a receiving tuner after the design given in the book "How to Conduct a Radio Club."

Concerning potentiometers: The better method for constructing a non-inductive potentiometer is to take two spools of the resistance wire and wind two layers side by side simultaneously. The beginning terminals should be connected together and the extreme ends connected to the source of energy. Constructed in this manner, inductive effects will be practically absent.

Regarding your last query: A multi-layered loading coil, regardless of the radio frequency circuit in which it is to be used, is not practical. A high frequency current will not traverse the turns of a multi-layered winding.

* * *

R. A. M., Ione, Cal., writes:

Ques.—(1) I have a 200 cycle, alternating current generator with a spark gap mounted on the end of the shaft. The oscillation transformer is placed about two feet from the generator. Are the windings of the generator liable to be short circuited or burned out by induction from the high voltage current flowing through the oscillation transformer?

Ans.—(1) If the frame of the generator is connected to earth, you need not fear that the windings of the generator will be affected by direct induction from the oscillation transformer. It is desirable, however, to keep the low voltage mains in a radio station at a considerable distance, or at least at right angles to the circuits of radio frequency.

Ques.—(2) I have an inductively coupled receiving tuner of the usual construction, but I cannot hear certain stations unless I set the secondary switch in contact with two taps. In other words, one section of the secondary winding is short circuited. What is the cause of this phenomenon?

Ans.—(2) This merely indicates that the multiple point switch fitted to your secondary winding does not afford sufficient closeness of adjustment to place the secondary circuit in resonance with the primary circuit. This can be overcome by fitting the secondary winding with a small variable condenser. Then the lack of closeness of adjustment in the secondary switch can be compensated for by small values of capacity at the condenser.

Ques.—(3) My 200-cycle generator has six poles. How many plugs should I use on the spark gap to get the very best results?

Ans.—(3) For a synchronous discharge there should be six electrodes on the disc. This will give a spark for each alternation and will produce a musical pitch.

* * *

A. C. M., Seattle, Wash.:

We advise you to secure a copy of the "List of Radio Stations of the World," on sale by the Marconi Publishing Corporation. The call letters of the Canadian Northwest stations are contained in this list.

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Ques.—On what wave-length does NPW (Eureka, Cal.) work?

Ans.—For commercial correspondence this station operates with the standard wave-lengths of 300 and 600 meters.

* * *

L. M. C., Rochester, Pa., writes as follows:

The belief is generally held by amateurs that the quenched spark gap is applicable only to 500-cycle sets. After an extensive series of experiments, I have fully satisfied myself that by proper adjustment and construction, it will give thirty per cent. better radiation than the average rotary gap. The tone is not high, but it is also far from a low pitch. In fact, it resembles a medium toned rotary gap, but is quite different in several respects.

* * *

P. E. M., Mount Pleasant, Ia.:

The apparatus shown in the photograph accompanying your query will undoubtedly permit the reception of Arlington time signals with the flat top aerial 150 feet in length. An aerial of this length raised sixty feet above the earth has a fundamental wave-length of approximately 400 meters and during the night hours should permit the reception of signals from the high power stations on the Atlantic and Gulf coasts.

* * *

R. P. B., Lockport, N. Y.:

There is no advantage in producing an excessively high spark note with the non-synchronous rotary gap. Apparently you are not familiar with the safe range for mechanical speeds. We have never heard of a rotary disc being driven at a speed of 12,000 R. P. M. and do not know any insulating material that will withstand the peripheral strain. The average rotary gap revolves at 3,000 R. P. M.

A transmitting set will have better carrying qualities with a non-synchronous rotary gap constructed to give from 200 to 400 sparks per second of time. The aerial, 90 feet in length by 65 feet in height, has a fundamental wave-length of approximately 280 meters.

* * *

H. A. D., Johnstown, N. Y.:

We have no record of a patent having been issued for the multi-audi-fone.

The fundamental wave-length of your two-wire aerial, 600 feet in length with a 300-foot lead-in, is approximately 1,450 meters. It is too long for the reception of either 300 or 600-meter waves. For the best signals at these two wave-lengths, the flat top portion should not exceed 200 feet in length.

* * *

M. R., New Haven, Conn.:

The wave-length of your aerial, 75 feet in length by 60 feet in height, is approximately 240 meters. The description of your receiving tuner indicates a possible adjustment to wave-lengths of 5,000 meters, if used with a crystalline detector. Since there are no spark stations operating at this wave-length, you should use some form of an oscillating vacuum valve circuit which will permit the reception of either damped or undamped oscillations. The coupler you describe is feasible, but it should be loaded in the primary and secondary circuits with loading coils of the type described in the book, "How to Conduct a Radio Club," under the heading "Beat Receivers." For the super-sensitive receiving set described in that issue, small variable condensers, procurable at amateur supply houses, are recommended. These generally have a capacity of .001 microfarad or thereabouts.

* * *

M. J. M., Albany, N. Y.:

It makes no difference if the primary and secondary windings of an inductively-coupled receiving tuner are wound in opposite directions. Complete data for the construction of a 1 k.w. open core transformer, to be operated on 60-cycle current, are given in the book, "How to Conduct a Radio Club." For operation on 40-cycle current, the impedance of the primary winding should be increased by additional turns.

* * *

C. H., South Norwalk, Conn.:

The book entitled "How to Conduct a Radio Club" has a number of diagrams applicable to all types of receiving detectors. You are advised to study carefully the chapter on the "Theoretical Explanation of a Receiving Tuner" and also, if possible, to duplicate the various diagrams of connections shown for the crystalline type of detector.

Your aerial has a fundamental wave-length of about 400 meters, which should give good response from commercial stations operating at wave-lengths of 600 meters. If you are a good operator and are able to interpret call letters, you should, by this time, have determined the full range of your set.

The vacuum valve detector is considered more sensitive than that of the crystalline type.

* * *

L. A. K., Mattoon, Ill.:

A loading coil 28 inches in length, 5 to 6 inches in diameter, covered with No. 22 S. C. C. wire, will boost the fundamental wave-length of your aerial system to approximately 10,000 meters. It is, as you say, quite necessary that another loading coil be inserted in series with the secondary winding to obtain resonance in the two circuits. However, it may be found that your present coupler will not afford sufficient closeness of coupling for strong signals. We assume you intend to construct a long distance receiving set, responsive to high-power stations. You, together with other inquirers regarding this subject, are referred to the book, "How to Conduct a Radio Club," which covers the subject fully.

* * *

F. M., Gravesend Bay, Brooklyn, N. Y.:

Like many other amateurs you have designed and constructed a receiving tuner that is responsive approximately to wave-lengths of 5,000 meters, but because there are no spark stations within your range using this wave-length, the tuner is useless. The longest wave-length employed by spark stations within your

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range is that of the Arlington station when sending the time signals, namely, 2,500 meters. The Sayville station formerly operated at wave-lengths of 4,800 meters, but the spark set has been put out of commission. You have shown that you are not entirely familiar with the variometer. Study Chapter IX of the book, "How to Conduct a Radio Club," which describes the subject in detail. Your apparatus certainly is responsive to Arlington time signals, but the tuner may have decreased dimensions and still respond to this station. The correct dimensions are fully described in the National Amateur Wireless Association Monthly Service Bulletin for January, 1916.

* * *

O. M. H., Whiting, Ind.:

The three-slide tuner, 17 inches in length by 3¼ inches in diameter, wound with No. 22 enamelled wire, connected to the aerial, 80 feet in length, should be responsive to wave-lengths of 3,500 meters. The inductively-coupled receiving tuner with the dimensions you have supplied will also be responsive to wave-lengths up to approximately 3,500 meters.

* * *

E. M., Ely, Minn.:

The fundamental wave-length of your antenna is approximately 220 meters, and if adjusted to resonance with the transmitting set described, will emit a wave-length in excess of this value. It is very difficult to estimate the range of an amateur transmitting outfit, but if the primary and secondary circuits are in exact resonance, your ¾ k.w. transformer should cover fifty miles. Of course the range will depend upon the type of apparatus employed at the receiving station. Some amateur stations fitted with sensitive receiving apparatus may be able to hear you during the night hours at a distance of several hundred miles. We do not know what effect the iron ore deposits in your vicinity will have, but if near to the surface of the earth they should, it seems, assist the passage of the electro-magnetic waves.

* * *

W. C. S., Freeport, La.:

A condenser for the restricted 200-meter wave, as we have stated many times in this department, must have a capacity of between .008 and .01 microfarad. Four plates of glass, 14 by 14 inches, covered with foil, 12 by 12 inches and connected in parallel, will give the desired value of capacity. If these plates will not withstand the potential of the transformer, you should connect eight plates in parallel in each bank and the two banks in series.

If the one to one transformer is to be used with the vacuum valve amplifier, you may purchase one of this type from the Manhattan Electrical Supply Company, New York City. The secondary winding of an induction coil or your 1 k.w. Thordarson transformer may be used as alternatives.

* * *

K. T. R., Newington, Conn.:

On page 860 of the August, 1915, issue of THE WIRELESS AGE is published a list of the high-power stations, employing damped and undamped oscillations, their call letters and the approximate wave-lengths at which they operate. Any type of oscillating vacuum valve circuit of the correct proportion will permit the reception of both damped and undamped waves. If the apparatus is adjusted to operate on the "beat" phenomenon, the note of spark stations is distorted and the resultant note is of a lower frequency. Apparatus of this type is described in detail in the book, "How to Conduct a Radio Club."

Damped oscillations are produced by the discharge of the condenser through a spark gap, while undamped oscillations may be supplied by a Goldschmidt high frequency alternator, an Alexanderson high frequency alternator, a Poulsen arc, or a battery of vacuum valves. A high frequency spark set is generally considered as one where the primary source of current has a frequency of 500 cycles a second. A high frequency generator is one supplying more than 20,000 cycles per second of time. The Goldschmidt alternator is operated at a frequency usually of about 50,000 cycles per second, corresponding to a wave-length of approximately 6,000 meters.

Apparatus for the reception of undamped oscillations, requires very careful design throughout and is difficult to manipulate at the first trial. A series of experiments are generally required to familiarize the manipulator with the method for best adjustment. Do not be surprised if your initial tests are not what you expected them to be. You will find circuits of this type extremely interesting, and with very small aerials they will permit the reception of signals at night time from high-power stations two or three thousand miles away. It is sometimes found difficult to make a vacuum valve oscillate at wave-lengths below 2,500 meters. They are more stable at frequencies corresponding to wave-lengths in excess of four or five thousand meters.

* * *

J. W. P., Newport, R. I.:

With so many wireless stations in commercial operation, it is difficult to ascertain the origin of the strange signals you hear. In view of the swinging tones, it is quite likely that you received signals from a station employing undamped oscillations. Take, for example, the station at Tuckerton, N. J.; owing to the unequal speed of the alternator, the pitch of the tone in a "beat" type of receiving apparatus varies.

* * *

T. P., Rocky Mountain, N. C.:

The diagram of connections sent to us indicates that you are not familiar with receiving apparatus. The secondary circuits in your drawing are improperly connected for either the crystalline detector or the Poulsen type of tikker. The tikker ought to be connected in series with the crystalline detector and the head-telephones connected in shunt to the fixed condenser. The fixed condenser is, of course, placed in series with the tikker and the crystalline detector. The latter may be omitted, al-

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though it has the effect of clearing up the pitch of the note.

What use have you for receiving apparatus adjustable to a wave-length of 10,000 meters? We are not aware that any stations operate at this wave-length. The greater part of commercial traffic at high-power stations is dispatched at a wave-length of 6,500 meters.

A ½ k.w. transmitting set will transmit during the daylight from thirty to fifty miles.

Your transmitting condenser has a capacity of .007 microfarad, which is quite correct for operation at wave-length of 200 meters and will permit from two to three turns to be connected in series with the primary winding of the oscillation transformer.

* * *

W. I., Springfield, Mo.:

Examine the diagram of connections for the crystalline vacuum valve combination described in the book, "How to Conduct a Radio Club." The condenser connected in series with the crystalline detector need not be variable in capacity. One of .005 microfarad capacity will do.

* * *

J. A. R., New York City:

An aerial with a flat top, 50 feet in length, is quite correct for the restricted amateur wave. Dimensions for receiving tuners to cover a definite range of wave-lengths, are given in the book, "How to Conduct a Radio Club." Connect one of your variable condensers in shunt to the secondary winding of the receiving tuner, and the other either in series with the antenna or in shunt to the primary winding, accordingly as a shorter or longer wave-length adjustment is required. For general receiving work, an amateur receiving tuner to be responsive to spark stations should have a maximum wave-length adjustment of 3,000 meters.

* * *

J. E. B., New York City:

The call letters BZR are those of the British naval station in Bermuda.

* * *

C. S. R., New Brunswick, N. J., says that he is about to erect an antenna 1,000 feet in length and has the necessary supports, insulators, etc., but that he is only able to make use of galvanized iron wire. He desires to know whether this antenna will be efficient.

Ans.—Undoubtedly signals will be received, but, of course, the high frequency resistance of this wire is greater than that of copper wire and consequently there will be some losses. The editor of this department has often used galvanized iron wire aerials, obtaining excellent results. Copper wire is preferable, however.

* * *

P. A. W., West Stockholm, N. Y., has an aerial 155 feet in length, 50 feet in height at one end and 65 feet in height at the other. It is composed of six No. 14 B. & S. aluminum wires, spaced 3 feet apart. He says that the lead-in wire is 125 feet long and wishes to know the natural wave-length.

Ans.—The natural wave-length of this antenna is about 410 meters.

Ques.—I am constructing a spark coil to be used on a 110-volt current in connection with an electrolytic interrupter. Does it require a primary condenser?

Ans.—No.

* * *

B. M., East Orange, N. J.:

The primary and secondary windings of the oscillation transformer for a quenched gap should be arranged so that the coupling between them can be very closely adjusted. Proper radiation from a quenched set is dependent upon a certain degree of coupling and very close adjustment of the inductance values in use at the primary and secondary windings of the oscillation transformer. We do not know the voltage of the secondary of your transformer, the number of plates in use at the gap, nor the general design of the condenser, but if the various portions of the equipment are fairly well proportioned, the quenched gap should consist of no more than two or three plates in series. When a quenched gap is used in place of the ordinary gap, a closer degree of coupling at the oscillation transformer may be employed than with the gaps of ordinary construction.

* * *

H. G. S., Irvington, N. J.:

The aerial described in your communication is "freakish" in the extreme and we cannot understand why you insist on such design. It has been proven that the best results are obtained with a long, narrow aerial rather than with one which is spread in many directions.

After looking at your diagram, we suggest that you stretch a single flat top aerial, if possible, in the 300-foot direction. A single wire, 300 feet in length, will certainly receive at a greater distance than a flat top aerial 80 feet in length.

* * *

R. D., Milwaukee, Wis., inquires:

Ques.—(1) Are the twelve-jar condensers and the type B oscillation transformer on sale by the Marconi Company suitable for use with a 1 k.w. 20,000 volt transformer and a rotary spark gap having six plugs revolving at a speed of 5,000 R. P. M.? This apparatus is to be operated on the 200-meter wave.

Ans.—(1) This condenser has a capacity of .009 microfarad which is quite correct for the 200-meter wave. We consider the speed of the disc discharger excessive.

Ques.—(2) I have two aerials placed at an angle of 150 degrees to each other. One aerial consists of two wires 175 feet in length, spaced 5 feet apart. The second aerial comprises four wires, 70 feet in length, and spaced 18 inches. Each aerial is 60 feet in height and fastened to the same mast. Which should I employ for transmission purposes?

Ans.—(2) For the restricted wave of 200 meters the small aerial should be employed The natural wave-length of the 70-foot aerial

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is approximately 239 meters, which requires a short wave condenser to be connected in series for operation on wave-lengths of 200 meters.

Ques.—(3) If the small aerial is used for transmission purposes and the larger one for receiving will there be any loss of transmitting power in the larger aerial?

Ans.—(3) There will be some absorption of energy by this antenna, but it will not be excessive provided the longer aerial is disconnected from earth during the period of transmission. We offer the further advice that for receiving from amateur stations the small aerial be employed for both transmitting and receiving purposes, while the large aerial is preferred for the reception of signals from stations using wave-lengths of 600 meters and more. The wave-length of the larger aerial is approximately 460 meters.

* * *

O. N., Washington, D. C., inquires:

Ques.—(1) Please give the dimensions for a loading coil to raise the wave-length of the primary and secondary circuits of the receiving tuner described to a wave-length of 16,000 meters. Please give the diameters of the tubes and the size of the wire.

The primary winding is 10 inches in length by 4¼ inches outside diameter, wound with No. 24 double silk wire. The secondary winding is 10 inches in length by 3½ inches in diameter, wound with No. 34 S. S. C. wire. The aerial with which this tuner is to be employed is 175 feet in length and consists of two wires with an average height of 55 feet. The lead-in is 50 feet in length. The aerial is of the inverted L type.

Ans.—(1) The fundamental wave-length of the antenna system is approximately 330 meters, and, assuming it to have a capacity of approximately .001 microfarad, the primary winding alone connected in series will allow the antenna circuit to be adjusted to about 5,000 meters. To be raised to a wave-length of 16,000 meters you require a loading coil approximately 4½ feet in length by 6 inches in diameter, wound closely with No. 22 single silk covered wire.

You can raise the wave-length of the secondary winding to a similar value by inserting a coil 6 inches in diameter, 28 inches in length, in series with the present secondary winding. This coil should be wound with No. 30 single silk covered wire. The loading coil and the secondary winding should be shunted by a variable condenser of small capacity.

Ques.—(2) With the loading coils cut out of the circuit can I receive stations above 1,000 meters, using dead end switches on the oscillation transformer?

Ans.—(2) Yes; sectionalize the windings, breaking both the primary and secondary winding into small units. With the secondary winding alone shunted by a variable condenser of .001 microfarad, it will respond to a wave-length of approximately 10,500 meters.

It may interest you to know that there are no wireless stations operating at a wave-length of 16,000 meters.

Ques.—(3) With the loading coil, oscillation transformer and vacuum valve detector referred to, and the same aerial with additional apparatus comprising three variable condensers, 2,000-ohm telephones, all apparatus being hooked up in accordance with one of the Armstrong circuits, how far can I receive undamped wave stations?

Ans.—(3) During the night hours you should hear the high-power stations at Nauen and Hanover, Germany. In daylight you may hear the government station located at Darien, Isthmus of Panama.

Ques.—(4) What is the range of wave-lengths of the oscillation transformer described in my first query?

Ans.—(4) This question is answered in the foregoing query. Both circuits are readily adjustable to a wave-length of 5,000 meters, provided the secondary winding is shunted by a condenser of small capacity.

* * *

F. D., New York City:

We are not familiar with the commutator scheme which your amateur friends employ for producing a high spark note with an induction coil. We have never obtained satisfactory results with a mechanical converter or interrupter with coils having a spark of more than five or six inches.

A spark coil is not designed for use as an open core transformer and we do not advise its use under any conditions. If you are forcing ten amperes on 110 volts through the primary winding of your 1½-inch spark coil, there is danger of burning this winding out; in fact, we do not believe it will stand continuous service.

* * *

C. B., Philadelphia, Pa.:

An aerial for long distance receiving purposes suitable for the reception of signals from high-power stations here and abroad should have a natural wave-length of, say, 2,000 meters. Two wires 1,000 feet in length with a distance of from 30 to 60 feet above the ground, will give fair results provided a supersensitive receiving set such as described in the July, 1915, issue of THE WIRELESS AGE is used.

The natural wave-length of the antenna described in your communication is about 430 meters.

The following dimensions are correct for a two-inch spark coil: The primary coil should be 7 inches in length by ⅝ of an inch in diameter, covered with two layers of empire cloth. It should be covered with 184 turns of the No. 16 D. C. C. wire. The secondary winding requires one pound of No. 36 enamelled wire in two sections, each section having a diameter of about 2¼ inches, the total width of the secondary winding being about 5¾ inches. There should be eight or ten layers of empire cloth between the primary and secondary winding. The primary

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condenser for this coil requires 1,400 square inches of coil.

* * *

C. D., Peekskill, N. Y., says:

Ques.—(1) I have the facilities for the erection of an aerial either 400 feet in length, consisting of four wires, or one 1,000 feet in length, comprising a single wire. I have the necessary apparatus modelled after that described in a previous issue of THE WIRELESS AGE under the heading "Supersensitive Receiving Set." Do you think it possible to hear Nauen, Germany (POZ), or Colon, Panama (NAX), during the winter months at nighttime?

Ans.—(1) The wave-lengths of the Nauen and the Colon stations are widely different. The Colon station operates for commercial service at a wave-length of 600 meters and makes use of damped oscillations, while the Nauen station operates on a wave-length of approximately 9,400 meters and makes use of undamped oscillations. Your four-wire aerial, 400 feet in length, will be satisfactory for the reception of Colon signals, but the 1,000-foot aerial is preferred for the reception of signals from Nauen.

Ques.—(2) Will a single wire aerial composed of three No. 20 bare copper wires stranded withstand a span or stretch of 1,000 feet?

Ans.—(2) Not under all conditions of weather. We should prefer a heavier wire, particularly during the winter months when sleet storms may be expected.

The Colon, Panama, station (NAX) maintains a continuous watch.

With an aerial 1,000 feet in length and the supersensitive receiving set referred to, provided you properly understand the vacuum valve detector, you should experience little difficulty in hearing the signals from the Nauen, Germany, station during the nighttime. In fact, by extremely careful adjustment, you should be able to hear this station during daylight.

* * *

O. M. B., Lawrence, Mass.:

The receiving apparatus modelled after the Marconi multiple tuner described in another publication was intended for use with a crystalline detector and is not equally applicable to the reception of damped or undamped oscillations as is the apparatus described in the book "How to Conduct a Radio Club."

It is a fact, as we stated previously, that when shellac is applied to the coils of a receiving tuner the effective distributed capacity of the coil is increased. There is no compound on the market which would eliminate this effect; in fact, it would be more or less present with all insulating compounds. To be avoided the wire must be applied to the coil without the shellac. The losses due to this effect may be considered harmful only when the last degree of efficiency is desired.

For information concerning the computation of the wave-length of an aerial from its dimensions you are referred to the article by Cohen, published under the direction of the Bureau of Standards.

Ques.—(3) When did the series of articles published in THE WIRELESS AGE, entitled "Operators' Instructions," begin?

Ans.—(3) Chapter I appeared in the July, 1913, issue of The Marconigraph.

Ques.—(4) Should I desire to prepare for the examination for a first-grade or second-grade commercial license what book would you advise me to obtain that would be of aid in securing the necessary information?

Ans.—(4) We recommend the following books: "How to Pass the U. S. Government Wireless License Examination," the "Naval Manual of Wireless Telegraphy" for 1915 by Commander Robison, and the "Text Book on Wireless Telegraphy," by Rupert Stanley. All are on sale by the Marconi Publishing Corporation, 450 Fourth Avenue, New York City.

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

of THE WIRELESS AGE, published monthly at New York, N. Y., for April 1, 1916.

State of New York, } ss.:
County of New York, }

Before me, a Notary Public, in and for the State and county aforesaid, personally appeared John Curtiss, who, having been duly sworn according to law, deposes and says that he is the business manager of THE WIRELESS AGE, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit.:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are:

Publisher, John Curtiss, 450 Fourth Avenue, New York; Editor, J. Andrew White, 233 Broadway, New York; Managing Editor, J. Andrew White, 233 Broadway, New York; Business Manager, John Curtiss, 450 Fourth Avenue, New York.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.)

John Bottomley, 233 Broadway, New York.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.)

None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a *bona fide* owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

JOHN CURTISS,
(Signature of Business Manager.)

Sworn to and subscribed before me this 8th day of April, 1916.

[Seal.] C. J. OLIPHANT.

Certificate filed in New York County No. 55.
(My commission expires March 30, 1917.)

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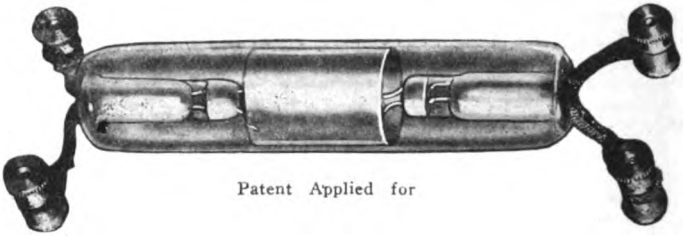

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# THE WIRELESS AGE

An Illustrated Monthly Magazine of
RADIO COMMUNICATION

Incorporating the Marconigraph

J. ANDREW WHITE, Editor — WHEELER N. SOPER, Asst. Editor

Volume 3 (New Series) — July, 1916 — No. 10


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# The National Association — What They Think About It

I have read all the matter and announcements concerning the whole idea very carefully and wish to say I think this proposition is a splendid one both for the amateurs individually and the Government (if the occasion should ever arise therefor) and you can figure on my most hearty approval and co-operation and help in any and all ways possible at any and all times. RALPH SHORT.

The address of Mr. White, printed in the November issue of THE WIRELESS AGE, was a message of hope and encouragement that should meet with a hearty response. It opened a vista to me, I know, and I look to the National Association as a means of fitting myself for future advancement. C. V. SMITH.

I received all of the Charter Members' Equipment and am much pleased with it, but the best of all is THE WIRELESS AGE. I would rather miss a meal than miss a single issue. J. C. HOLLMANN.

I am heartily in favor of your association and think it by far the best one. I have been interested in wireless for five years, and have often wondered why some such organization was not formed before.
E. FORD.

I am more than pleased with the equipment, to be frank. It greatly exceeded my expectations, and I was unaware that there were two books on the market that covered the subject of wireless so completely.
N. B. SCHOTT.

"How to Conduct a Radio Club," is a real pippin, and the rest of the charter members' equipment is fine. I was going to ask how long the charter memberships would be held open and I found it in "How to Conduct a Radio Club." Believe me, it certainly sounded good to my ears to hear that the charter memberships would be held open until May 1st. Wishing you the best of success, I remain, CHAS. H. BELL.

**NATIONAL AMATEUR WIRELESS ASSOCIATION, 450 Fourth Ave., New York**

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# THE WIRELESS AGE

Owing to the fact that certain statements and expressions of opinion from correspondents and others appearing in these columns from time to time may be found to be the subject of controversy in scientific circles and in the courts, either now or in the future, and to sometimes involve questions of priority of invention and the comparative merits of apparatus employed in wireless signaling, the owners and publishers of this magazine positively and emphatically disclaim any privity or responsibility for any statements of opinion or partisan expressions if such should at any time appear herein.

JULY, 1916

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*The head of the column at the beginning of the line of march, showing the marshal and staff and a battalion of the 1,300 young soldiers on parade before 300,000 New Yorkers*

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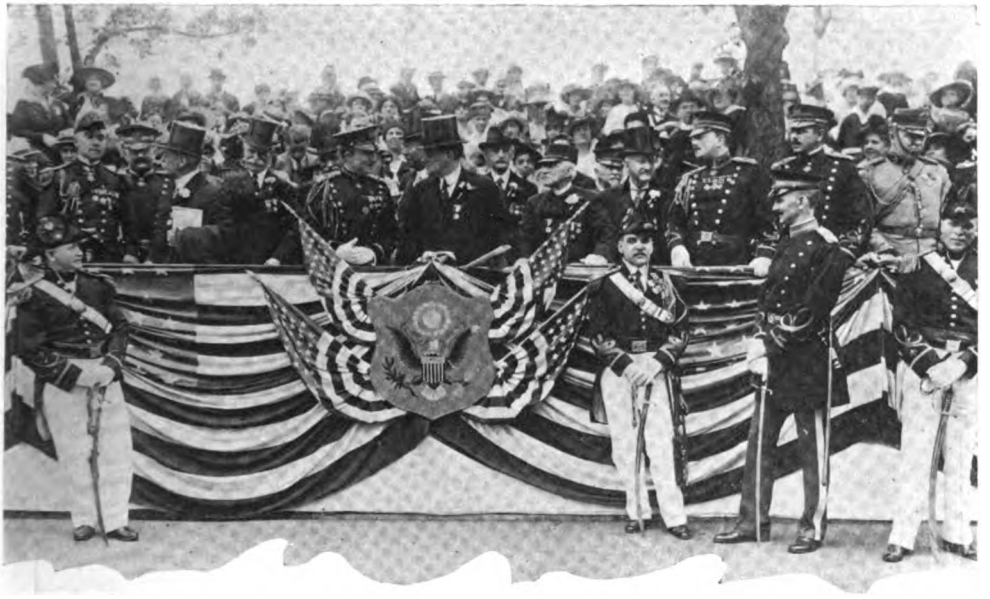

*Governor Whitman, of New York, and staff in the reviewing stand*

# Parade of the New York Signal Corps as Third Line of Defense for the Nation

## Description of the Memorial Day Review

OVERHEAD a canopy of fleeting clouds with a background of blue sky; underneath, with green foliage and handsome buildings as a setting, a vast throng of enthusiastic spectators; passing in soldiery array before this press, with bands playing and flags flying, a mighty host, of which the members of the National Amateur Wireless Association, affiliated with the Junior American Guard, were conspicuous figures.

These were the marked features in New York City's annual Memorial Day procession in Riverside Drive.

It was a red letter occasion for the members of the Association and the Guard. For months they had been going through the comparatively dull routine of drill and military tactics, preparing themselves to be defenders of the nation, and the parade gave them their first opportunity to appear as soldiers under the batteries of thousands of eyes. In the same column with gray-haired men who had distinguished themselves in the country's service in years gone by they marched up the Drive from Seventy-eighth to Ninety-second streets, ripple after ripple of applause greeting their appearance.

To the 300,000 spectators lined up on either side of the Drive and distributed at points of vantage on piazzas, in windows, automobiles and even on roofs of apartment houses and residences the Signal Corps Battalion of the Junior American Guard and its wireless equipment were apparently objects of endless interest. All along the line of march the U. S. army wireless cart and set, donated to the 1st Battalion Signal Corps by the Marconi Wireless Telegraph Company of America attracted widespread atten-



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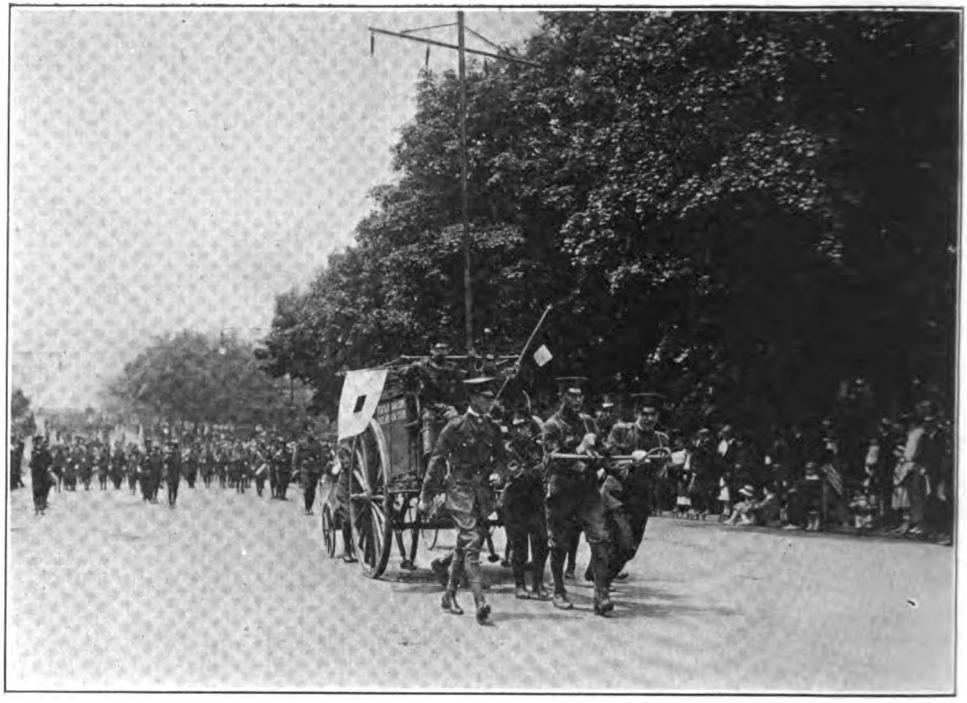

*One of the most conspicuous features of the parade was the wireless cart of the 1st Battalion Signal Corps, followed by the more mobile units of light equipment*

tion. Drawn by members of the Guard in a combination of field and dress uniform, it was perhaps the most conspicuous feature in a pageant which was replete with martial features. Viewing the procession from the upper windows of apartment houses, the aerial mast stood out prominently, attracting the eye even before it came close enough to be identified as part of a wireless equipment. On the sides of the cart were the words, "1st Battalion Signal Corps, Junior American Guard." The wireless pack sets carried by members of the Signal Corps were the subject of considerable comment, and the machine guns aroused interest.

More than a thousand members of the National Amateur Wireless Associations and the Guard were in line. Their enthusiasm regarding the parade and things military had been increased perhaps by the fact that the opening of the Association's summer camp at Birchwood Lake, Sullivan County, N. Y., where drills and preparedness practice will be the order of the day, will occur in July.

When the members of the Association and the Guard gathered in Seventy-eighth street, near Broadway, soon before nine o'clock in the morning to form in line they looked somewhat apprehensively at the lowering clouds. A short time afterward, however, the sun broke through and the threatening skies rolled away. It was more than an hour later when the Junior American Guard division swung into the line of march which had formed at Seventieth Street.

Mounted on horses were the marshal, Major William H. Elliott, and his staff, consisting of Major J. Andrew White, chief signal officer, Captain Joseph T. Griffin and Lieutenant Heyworth J. Campbell. The First Battalion Signal Corps, under command of Major White, consisted of two companies commanded by Captain C. F. White and Captain Logan, the main wireless section, of course, being included in this corps.


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In the line of march were the First Provisional Regiment, headed by a brass band and forty pieces of field music, comprising the Seventh (St. George's) Battalion, Major George Grocott commanding; the Eighth (Washington Heights) Battalion, Major Edward E. Gilman commanding; the Third (Lenox Hill) Battalion, Major George C. Erbeck commanding; the Second Provisional Regiment, consisting of the Lone Star Battalion Fife, Drum and Bugle Corps; the Second (Lone Star) Battalion, Major Charles S. Nyman commanding; the Twelfth (Cayuga) Battalion, Major Charles Frieder commanding; the Sixth (U. S. Grant) Battalion, Major R. S. Davis commanding; the Nurse Corps Detachment (Lone Star Battalion); the Third Provisional Regiment, consisting of the Alexander Battalion Fife, Drum and Bugle Corps; the Twenty-first (Alexander) Battalion, Major J. H. C. Smith commanding; the Sixteeenth (Bayonne) Battalion, Major Warren Roy commanding, and the wireless detachment (Alexander Battalion).

At the reviewing stand at the Soldiers' and Sailors' Monument at Eighty-ninth street was Governor Charles S. Whitman. Five members of the Board of Governors of the Junior American Guard were on the governor's staff. They were Colonel Charles Elliot Warren, Lieutenant Commander Louis M. Josephthal, Major Francis L. V. Hoppin, Captain Alvan W. Perry and First Lieutenant Maunsell S. Crosby.

The parade disbanded at Ninety-second street and Broadway, where the wireless cart was surrounded by an interested crowd, several of the spectators being so much impressed that they enrolled at once as members of the Signal Corps.

Several complimentary expressions of opinion regarding the Guard came from men of prominence. Brigadier General Andrew C. Zabriskie, who commands the organization received the following letter from Colonel Warren:

June 1, 1916.

I am sure you will be gratified to

*The three provisional regiments were headed by the staff officers; these are, reading from left to right, Major White, Chief Signal Officer, Captain Griffin and, in the foreground, Major Elliott, Adjutant General*

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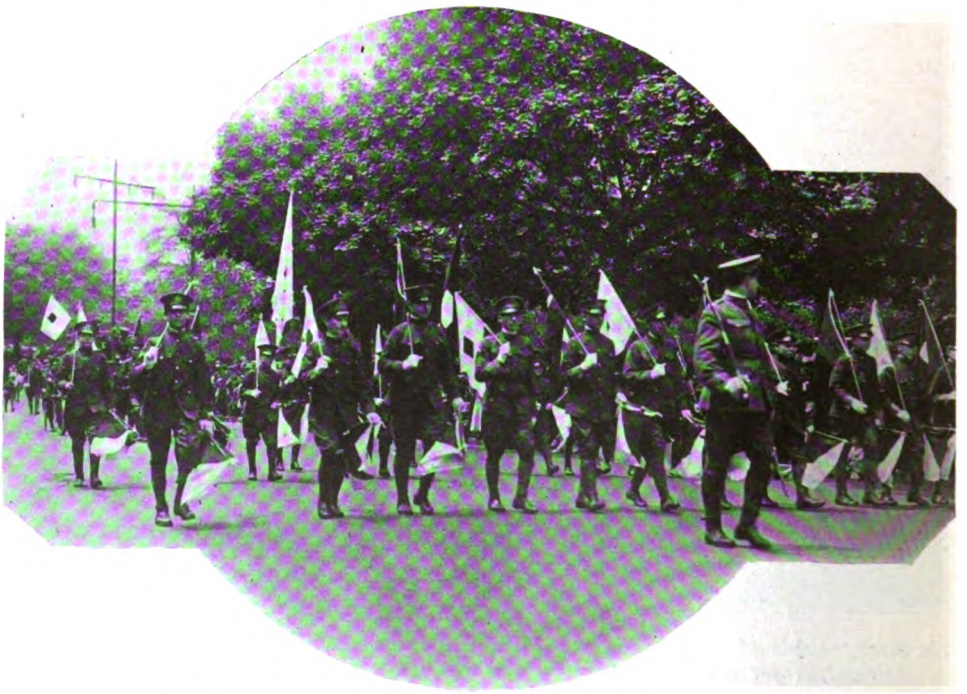
*The "mother station" wireless cart swinging into line*



*A signal corps company, showing wig-wag and semaphore flags*



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know that we were all very much pleased with the appearance of the Junior American Guard, in which you are so deeply interested, on the occasion of the Memorial Day parade. I was in command of the Guard of Honor to the Governor, and I said to him as your boys marched by that I had the honor of being on the Advisory Committee, Board of Governors, of this guard, and that personally I was pleased to see the tremendous strides they had made. They really presented in every way a most creditable, excellent, military appearance, and were all commended by the Governor, the Adjutant-General, and everyone on the stand.

The governor had a staff of about fourteen officers with him: and they all, barring the Governor himself, who was called elsewhere, lunched with the Veteran Corps of Artillery at the Columbia Yacht Club immediately after the review, and individual members of the staff were all of the same opinion concerning the members of the Junior American Guard. I cannot speak too highly in their praise. They are certainly splendid young soldiers; and you can be quite satisfied that they will prove in after life a credit to you and your continued effort for their development and good.

*The staff reviewing the Junior American Guard at the end of the march. From left to right: Major William H. Elliott, marshal; Lieutenant Heyworth J. Campbell, Major J. Andrew White, Captain Joseph T. Griffin*

Very sincerely yours,

(Signed) CHARLES ELLIOTT WARREN.

This tribute was paid to the Signal Corps Battalion by Major Elliott:

June 3, 1916.

Major J. Andrew White, Acting President,
National Amateur Wireless Association,

Dear Major White:—

General Zabriskie wishes me to thank you for your co-operation in helping to make the Memorial Day parade a success, so far as the Junior American Guard was concerned.

The Signal Corps Battalion, organized under your direction, made an excellent showing and the wireless cart and equipment donated to us by the Marconi Company was a wonderful addition to our division and was commented upon very favorably by several members of our Executive Committee, who are members of the Governor's staff and who accompanied him as Reviewing Officer on Memorial Day.

Kindly convey our sincere thanks to the Marconi Company for the privilege extended to us in allowing us to use the wireless cart and equipment.

Commander F. M. Tiernan, grand marshal of the Grand Army of the Republic, wrote Major Elliott that "It affords me great pleasure to compliment you and the Junior American Guard of your division for the splendid showing in the Memorial Day parade."

Following the exhibition of the wireless cart in the procession there were many inquiries regarding the equipment. The set is made up of apparatus of the type used by the Marconi Company for auxiliary equipment—an installation that has stood the test of operation in life and death emergencies. It was this type of set that Jack Binns employed to flash the S O S from the steamship Republic when she was wrecked. Numerous instances of its efficiency have been recorded from time to time.

The equipment consists of a Marconi 10-inch induction coil, leyden jar condenser, a set of storage batteries, an ordinary Marconi type key, a type 107-a tuner, and an aerial tuning induc-

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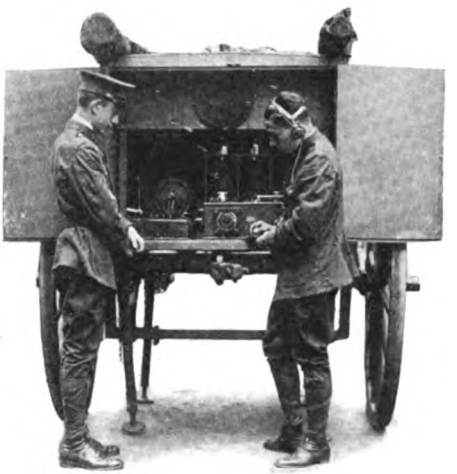

*The signal corps cart open and working; showing 10-inch induction coil, aerial tuning inductance, leyden jars and tuner. On the top of cart are mast sections encased*

ance of the latest type made up of a copper strip spiral wound on a large disk of insulating material. The spiral is of the type used on modern Marconi commercial apparatus. All of these parts are mounted in the wireless cart, which is of the regulation signal corps type.

The detector on the tuner is of a carefully selected quality of carborundum which is mounted in standard Marconi crystal holders. A pair of double head phones are employed for receiving.

The mast attached to the cart is portable and can be increased or decreased at will. When raised to its full height, it extends sixty feet into the air. The aerial comprises four wires running from the top of the mast down to the leading-in insulator on the cart. The aerial is insulated by standard Marconi aerial insulators of the kind employed in the merchant marine.

Under favorable conditions and with the aerial raised to its greatest height the set can transmit from twenty-five to fifty miles. Its maximum receiving range is about 150 miles.

Questions from applicants resulted in an interesting talk by the commanding officer, after the parade. It was explained that there are many uses to which the portable set can be put in active army service. For instance, a detachment of the signal corps is detailed to accompany the main body of the independent cavalry, many miles ahead of the regular base of the army. Of course time is at premium and knowledge of events is essential to the commander of the main force. So the advance Signal Corps men are depended upon to establish when necessary instant communication with the base. With the main body of the army is a portable set mounted in a cart. The cavalrymen, however, take with them pack sets borne by horses.

For hours, perhaps days, the advance may proceed without incident. Scattered far and wide over the country are the men of the cavalry, keeping a sharp lookout for the enemy. Then, while the men are pressing swiftly onward, comes a sharp command to halt. The enemy's outposts are at hand and it is imperative that the officer at the base should be informed of this fact at once.

"Open section" is the command given by the section chief to the men of his command and they turn and dismount. The horses are placed in a circle and the men give their attention to the burdens borne by the pack animals. These loads consist of boxes containing wireless apparatus and sections of poles. On the back of one of the horses is a small iron frame. When the latter is taken from the horse one man raises a section of a pole to which is attached the antenna. A man on the frame lifts the pole and section after section is joined to it.

Comes next the task of driving the insulating pegs into the ground and dragging out four long lines of wires which make up the counterpoise or artificial ground. Adjustments of wires are made, the chest is coupled to a wire from the mast, and connections effected with the ground. A hand generator, connected to the instrument chest, is fastened to the iron frame and the set is ready for operation.

Hurriedly the commander of the cavalry scribbles a message to the general at the base, giving him the information wanted, and places it in the hand of

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the sergeant at the head of the Signal Corps. At the main headquarters of the army the wireless cart set and its operators are ready to receive the communication and with lightning-like speed it is delivered to the general.

Thus has the portable wireless set done away with the necessity of sending mounted messengers back to carry communications—a long, hard journey involving loss of time, the risks of being cut off by the enemy, and the consequent failure to deliver the communication.

During the trouble which the United States had with Mexico in 1914 the Mexicans demanded the surrender of the detachment which was guarding the water works at El Tejar. In command of the small American force was Major Russel. It looked like a serious situation for his men, who were considerably outnumbered by the Mexicans. However, disregarding a demand to surrender, he flashed a wireless message to General Funston at Vera Cruz. Came a reply by wireless within a few minutes that reinforcements were hurrying to El Tejar. As a result, within an hour the little garrison caught sight of the uniforms of seven companies of the Fourth Infantry and two battalions and three companies of marines.

Excellent examples of the efficiency of the United States Signal Corps were afforded in Vera Cruz. Marines from the transport Prairie had not been ashore more than an hour when members of the Signal Corps had erected a mast on top of the Terminal Hotel. By means of the installation information and requests for instructions were transmitted to Rear Admiral Fletcher in the harbor, thence to Rear Admiral Badger, who was nearing Vera Cruz with another division of the North Atlantic Fleet.

A large force of Mexicans was discovered hurrying over the hills on the

*Arrival of the first radio section of the 1st Battalion Signal Corps for the Memorial Day Parade in New York. Two sections of the 60-foot mast were erected and carried throughout the line of march for exhibition purposes*

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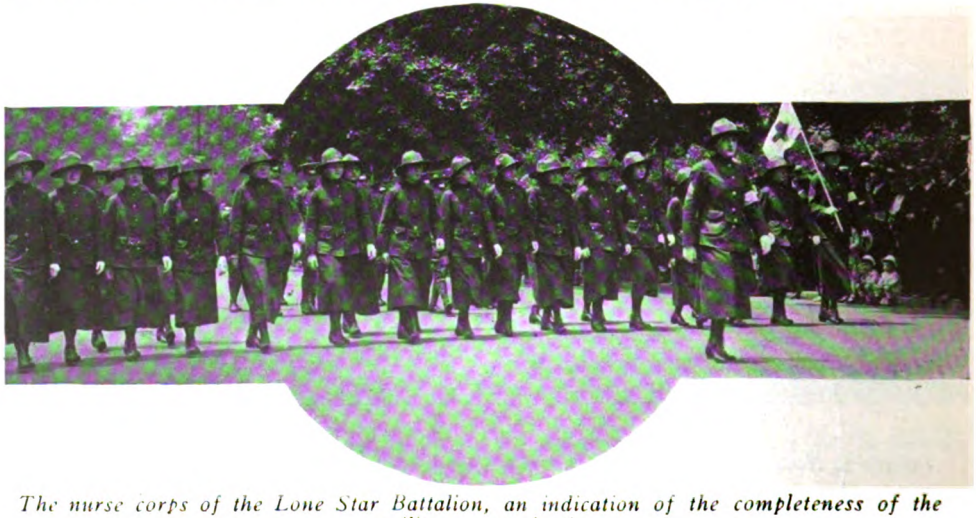
outskirts of the city soon after the Americans took possession of the custom house. It was apparent that their intention was to flank a United States battalion in the railway yards. A wireless message containing this information was therefore sent at once to the Prairie and the transport's guns effectually blocked the interference of the enemy.

An officer of the National Amateur Wireless Association pointed out that the basic principle upon which signaling companies operate is to provide for transmission of information and orders from commanding officers to their subordinates and returning information from these subordinates to the commanders. In war times communication without interruption must be established and continued. The means employed are visual or electric signaling and the troops are expected to execute the orders of their commanders no matter what difficulties it is necessary to overcome in order to do so. Visual signaling is employed only when electrical means of communication does not avail, but it is obvious that the members of the signal corps are expected to comprehend the various methods of signaling.

When a company is organized it is divided into wire and wireless sections. In the wireless section are placed all of the recruits detailed to the establishment and maintenance of a wireless station. One first-class sergeant, who is chief of section; one sergeant, two corporals, operators, antenna men and messengers make up a pack wireless section. In a wagon wireless section will be found one first-class sergeant, who is chief of section; one sergeant, two corporals, the engineer, the wagoner, operators, antenna men, guy men and messengers. A first-class sergeant as chief of section, one sergeant, two corporals, operators, linemen and messengers comprise the wire section. Pack wireless sections make up the first four sections of a field wireless company; the remaining two are wagon wireless sections.

Included in the means of electrical signaling are the wireless telegraph, buzzer and telephone. Members of the National Amateur Wireless Association have been advised to familiarize themselves thoroughly with the code in order to meet any emergency that may arise as signal corps men. The Signal Corps, it should be understood, is called upon to keep parallel columns in communication while marching, and it may also be commanded to "jam" the stations of the enemy. Whether in the field, on the march, or in battle, it is essential that the detachments be near the commanding officer with whom communication is to be maintained. As a rule, the signal officer retains a position near the commanding officer in order that he may keep well in touch with the situation.



*The nurse corps of the Lone Star Battalion, an indication of the completeness of the military organization*

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# The Summer Camp of the N. A. W. A.

## Birchwood Lake, Where Drills and Preparedness Practice Will be the Order of the Day

NESTLED among the ranges of the Shawngunk Mountains in Sullivan County, N. Y., 1,600 feet above the level of the sea, is picturesque Birchwood Lake, the site of the summer camp of the members of the National Amateur Wireless Association. Here on July 1 the outdoor home of the Interstate Military and Athletic Encampment Association, with which the National Amateur Wireless Association and the Junior American Guard are affiliated, will be established.

Birchwood Lake is about four miles south of Monticello and a little more than 100 miles from New York City. Arriving at Monticello, the campers will be transported along a road that winds up and down through thickly wooded country.

On the south shore of the lake is a rebuilt farm house which will be used as the general headquarters of the camp. It is a large structure with two wings, one of which is two stories in height and the other three. There are twenty rooms with windows, commanding an attractive view of the lake and the surrounding country. One large room will be used as a dining hall which will accommodate 400 persons.

The official headquarters of the National Amateur Wireless Association and the wireless station to be operated under its auspices will be located on a knoll in the rear of the house. A tall pine tree may be used as one of the supports for the antenna. In charge of the station will be a competent operator who will also give instruction in the art. A number of pack sets to be provided by the National Amateur Wireless Association for its members will be used to supplement the work of the station. It is expected that the station will be the center of activities in the camp, for there are several amateur equipments in Monticello and the neighborhood which will doubtless be in touch day and night with Birchwood Lake.

Out of the 300 acres which the camp will occupy 100 acres consist of cleared ground. The fields are segregated by trees fifteen to fifty feet in height, so that the various divisions of the camp will have independent quarters. A fifteen-acre tract has been laid out for field manoeuvres which will be among the most attractive features of the camp life.

In addition to the routine program mapped out for those who go to the camp several other diversions have been planned. A bathing pool has been built and the lake provides boating and excellent pickerel fishing. There are many points of interest within hiking distance. Among them is the 25,000-acre deer preserve of C. W. Chapin at Lebanon Lake, two miles away. Nearby also is the preserve of the Patchogue Rod and Gun Club. The camp is about a mile from the Mongaup River and a half mile from the crest of the ridge overlooking the Mongaup Valley. At the head of the valley in the town of Liberty.

Officers of the National Amateur Wireless Association recently visited Birchwood Lake to inspect camp sites. Members who wish to go to the camp should make application to the head-



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quarters of the Association at No. 450 Fourth avenue, New York City. For $2 a week a member of the Association will be able to obtain sleeping quarters in a tent. It is optional whether he obtains table board with the accompanying service in the dining room in the headquarters building at $8 a week or joins a company having a cook who will buy food from the commissary. In the latter case the cost of the camper's meals will be $2 a week. Therefore he has the choice of board and lodging at $4 or $10 a week. From July 5 to September 9 the Erie Railroad will sell round trip tickets from New York to Monticello for $1.50.

Officers of the Association have strongly indorsed the camp and its objects, pointing out that it provides healthful, instructive recreation as well as the advantage of meeting and exchanging ideas with well known amateurs. The camp will remain open until September 9.

*This photograph shows a view of Birchwood Lake, which will play an important part in the recreation of the campers. The lake attracts a considerable number of fishermen to it every year because of its reputation as the home of pickerel that are not too wary to be caught. It will provide boating as well as fishing for the wireless amateurs*

*A rebuilt farm house, a large building with two wings, will be used as the general headquarters of the camp. In the structure are twenty rooms, one of which will be turned into a dining hall. The windows of the building command attractive views of the lake and the surrounding country*

*One of the most prominent features of the camp will be the wireless station to be maintained by the National Amateur Wireless Association on a knoll in the rear of the general headquarters. A tree which may be used as a support for the aerial of the equipment can be seen in this picture of the camp*

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# How To Conduct A Radio Club

*(Especially Prepared for the National Amateur Wireless Association)*

Receiving Detectors For Wireless Telegraphy.

**By Elmer E. Bucher**

**ARTICLE XXV**

IN the article of this series published in the June issue of THE WIRELESS AGE, the two chemical receiving detectors, the whisker-point electrolytic and the primary cell detector, were discussed. Some important points concerning the adjustment and manipulation of the various types of crystalline detectors will now be taken up.

*Mineral Detectors*—Certain minerals found in Mother Earth, or crystals compounded by various processes, possess the property of rectification and will accordingly convert an alternating current of radio frequency to a unidirectional or pulsating current, thereby changing the signals of a distant transmitting station to a form suitable for attracting the diaphragm of a telephone receiver. One of the most rugged and practical of all crystalline detectors is the crystal of carborundum, which is much used at commercial radio stations.

It should be known at the start that the crystal of carborundum is not a native mineral, but a product of the electric furnace, a combination of sand, salt, sawdust and coke. The finished crystal is known to chemists as carbide of silicon.

*The Carborundum Detector*—Although various holders have been devised for crystals of this type, and all are to some extent satisfactory, the one shown in Fig. 5 is recommended, since it allows a sensitive point to be located at any point on the crystal. The crystal of carborundum, R, is imbedded in Woods metal or other soft metal in the containing cup, C. The movable arm, A, has a double movement, sidewise, at the point B, and "round and round" at the offset cup, C-1. A steel phonograph needle is soldered in this cup with a slight portion of the point projecting.

*Adjustment*—Sensitive carborundum crystals cannot be told at sight, nor can specific instructions be given for locating the sensitive point. It is sufficient to say, however, that the steel needle is oriented about the crystal and "jabbed in" at different spots until a buzzer tester indicates a sensitive condition. As compared with certain other crystals, this one demands a rather heavy pressure on the contact, C-1.

The adjustment of this detector cannot be considered complete until correct values of current from the local battery, B, are applied.

*Circuit for the Carborundum Detector*—The preferred diagram of connections for the carborundum crystal appears in Fig. 7. The head telephones, P, are of 2,000 to 3,000 ohms resistance, the potentiometer, P-1, has a value of 400 ohms and the battery, B, an electromotive force of 3 volts. The condenser, C-2, may have a value between .01 and .04 microfarad. As it is extremely important that the current from the battery, B, flow in a certain direction, the connections to it should be reversed during the test; the same effect is obtained by turning the crystal about in the holder, the former being left in the position where the loudest signals are obtained.

With the usual crystals of carborundum the use of the local battery is absolutely essential; therefore the potentiometer should be one giving fine gradations of the applied voltage.

Some experimenters prefer for the carborundum detector the circuit indicated in Fig. 6, stating that it gives added response from a given station.



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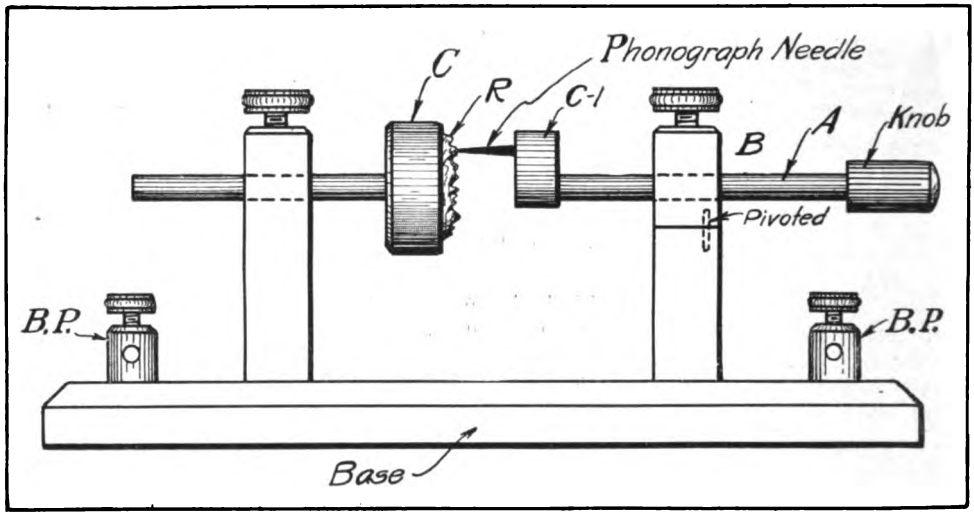


*Fig. 5*

It will be noted in this diagram that the telephones are shunted about the fixed condenser of the local circuit, the potentiometer being connected in series. With a circuit of this type it is often of value to have the condenser, C-2, variable in capacity.

*The Galena Detector*—This mineral is a natural sulphite of lead, generally found in the formation of cubical crystals. It has a blue gray color with a noticeable metallic lustre. One of the peculiar characteristics of this crystal when used as a wireless telegraph detector is that no local battery is required and that the opposing contact must be extremely light. The crystal holder indicated in Fig. 5 is applicable to galena, but the phonograph needle must be removed and a very light piece of elastic wire wound in the form of a spring substituted.

*Adjustment*—Specific directions for the adjustment of galena crystals can-

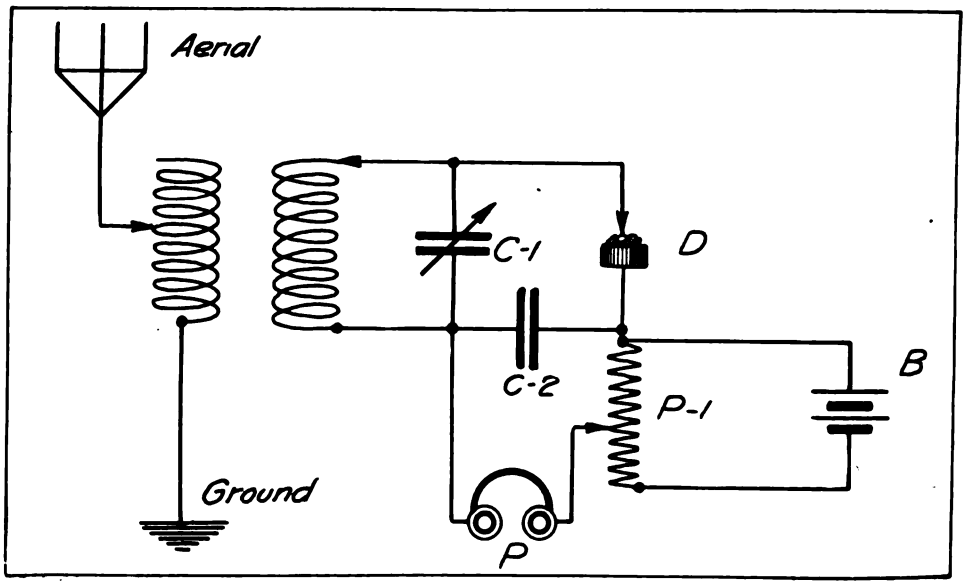


*Fig. 6*

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not be given, but the fine point should be placed in light contact with the crystal at various points until by means of a buzzer tester the most sensitive spot is located.

If a more positive contact than that afforded by a "whisker" is desired, a piece of graphite from a lead pencil may be employed. Increased pressure can then be applied.

*Circuit for Operation.*—The best circuit for the galena detector is that shown in Fig. 6, provided the potentiometer and battery are eliminated from the telephone circuit. With certain crystals of galena, the author has obtained increased sensitiveness by the use of a very small potential from the local battery, but to obtain similar results there must be connected in series with the main potentiometer a fixed resistance of about 2,500 ohms.

*The Zincite-Bornite Combination.*—Because of the ease with which a sensitive spot is located many amateurs favor this combination of minerals, but owing to the fact that adjustment of the detector cannot be continuously maintained under the rugged conditions of commercial or amateur service it is not as well adapted to practical use as some other crystals, notably carborundum.

Zincite is a native oxide of zinc. It is a rather brittle substance of blood red color, due to the presence of manganese.

Bornite is a copper ore consisting of about sixty parts of copper, fourteen of iron and twenty-six of matrix crystals. It possesses a rather odd bronze color.

The crystal holder in Fig. 5 is suitable for this combination of minerals. It is the custom to place several crystals of zincite in the large cup, C, and a single crystal of bornite in the revolving cup, C-1. During adjustment the crystal of bornite is touched at various spots on each of the crystals of zincite until a sensitive spot is located. A slight electro-motive force from the local battery is of great value to this detector; hence the circuit shown in Fig. 6 is correct, provided a fixed resistance of about 2,000 ohms is connected in series with the usual potentiometer of 400 ohms.

With a fresh set of crystals this detector is found to be more sensitive than crystals of carborundum and hence will give the stronger signals from a given station.

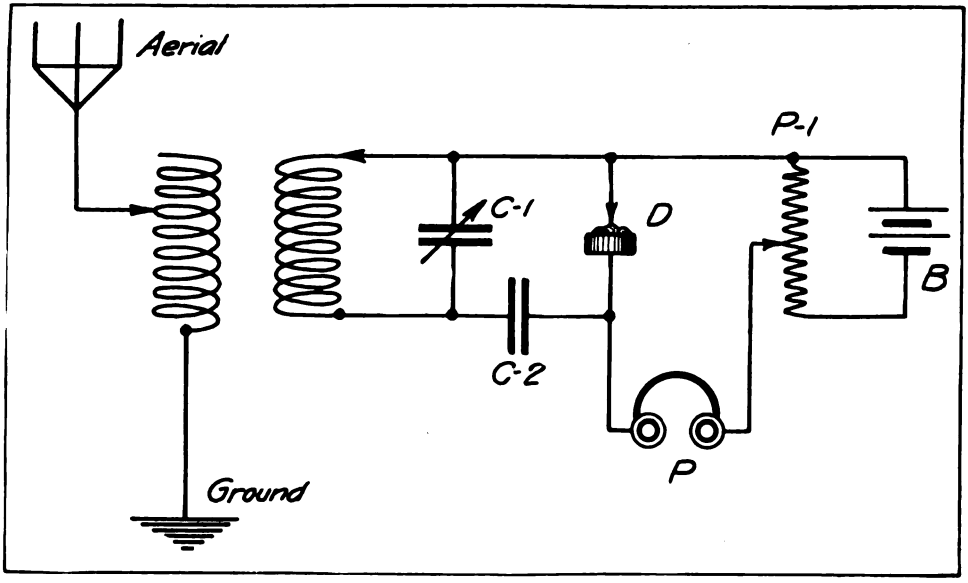


*Fig. 7*

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In the earlier forms of the device copper pyrites or chalco pyrite was used in place of the bornite crystal and it was frequently observed that a sensitive spot could be located more easily with the latter combination than with the one previously described. A copper pyrite crystal is easily distinguishable. It is a copper sulphate containing considerable iron, possessing a brilliant brass yellow color and a rather bright metallic lustre.

With either combination of elements it is necessary from time to time to clean the zincite crystals because the filings from the bornite or chalco pyrite crystal caused by rubbing the two crystals together may deposit themselves upon the crystals of zincite, thus destroying the sensitiveness. The crystals of zincite may be cleansed with ordinary soap and water, with gasoline or with a solution of carbon bi-sulphide. After the crystals are thoroughly dry they will be found, to some extent, to possess their original degree of sensibility.

*The Silicon Detector*—Silicon is non-metallic and one of the most abundant elements in nature. It is not, however, found in an uncombined state. The crystals used in wireless telegraphy are a gray metallic looking substance. This element possesses properties somewhat similar to that of galena, and, like galena, generally requires a rather light opposing contact. Hence it is customary to use a small whisker point of steel wire or other elastic wire for making contact with various points on the crystal. The holder described in Fig. 5 is applicable to this crystal, but the cup, C-1, is fitted with a light piece of wire in place of the rigid steel phonographic needle. The silicon detector functions with or without a local battery, but with certain types of crystals the best results are obtained by the slight application of a local potential.

In one form of silicon detector the crystal is ground down on an emery wheel to a smooth polished surface, but amateur experimenters frequently report that they obtain the best results from the rough crystals in their natural state.

As in the case of the galena crystal we can, in this instance, apply the diagram of connections in Fig. 6, provided a fixed resistance of 2,500 ohms is connected in series with the standard potentiometer.

It is needless to say that a number of other elements have been found to possess the property of rectification. For example, the crystal of molybdenite in conjunction with a contact of copper has been found to possess a considerable degree of sensibility. Likewise, a crystal of iron pyrites in combination with a steel contact will act efficiently as a receiving detector. Occasionally a crystal of tellurium with a contact of aluminum is used. In fact any single element of the foregoing combinations may be combined with an element of another combination. For example: Zincite and galena give good rectification and are fairly sensitive. Likewise iron pyrites and zincite are often used in combination. A crystal of zincite in contact with a piece of light steel will act as a detector of radio signals. A crystal of copper pyrites in contact with an extremely light wire "whisker" often responds with marked intensity to the signals of a distant station; but it is found extremely difficult to keep this arrangement in adjustment.

*A New Holder for Carborundum Crystals*—A sensitive spot on a carborundum crystal may often be more quickly obtained by means of the holder and the method indicated in Fig. 8.

The overhanging arm, A, carries the vertical post, B, cut with gear teeth to take the gear wheel, G. At the lower extremity of the rod is placed the cup, E, in which is mounted the carborundum crystal, D, by means of Woods' metal.

The lower cup, H, may be of glass, brass, rubber or copper and is filled with mercury to about one-half its depth. It should be 1 inch in diameter, and about 1 inch in depth. It is, of course, connected to the binding post, B, by means of a wire running underneath the base.

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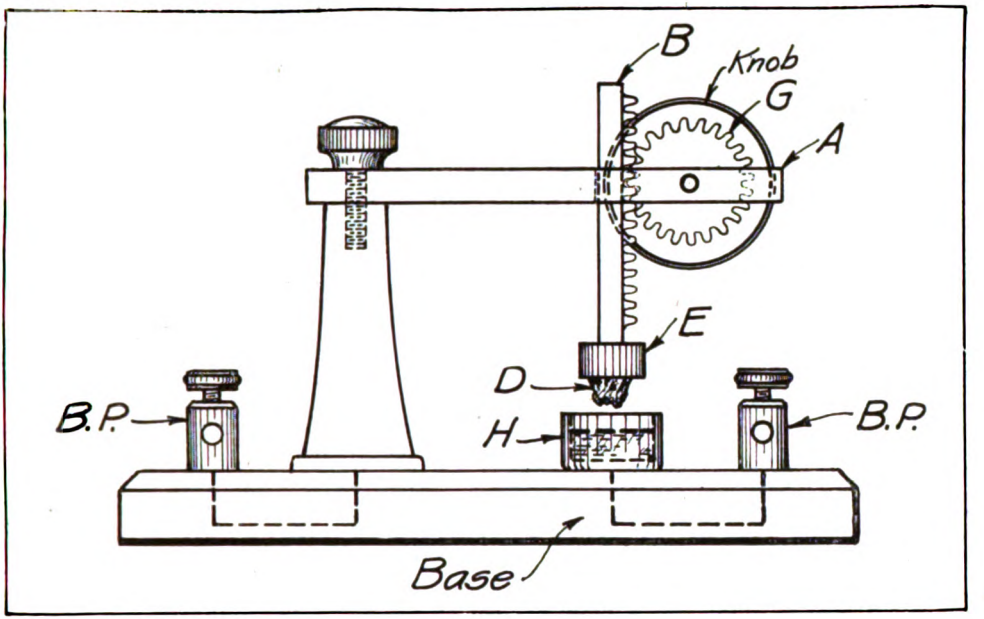


*Fig. 8*

During the adjustment the crystal, D, is gradually lowered into the mercury in the cup, H, until a sensitive spot is located. If care is taken to place this detector in a spot free from vibration the adjustment will be maintained indefinitely. It has been found that a more sensitive adjustment is obtained with this device than by means of the ordinary sharp-point contact. It is probable that similar results might be obtained with other crystals by means of the mercury contact.

*The Filings Detector*—There has recently appeared on the amateur market in the United States a new form of crystalline detector modeled somewhat after the original Marconi coherer, consisting essentially of a cartridge, C, Fig. 9, in which are placed two brass lugs, D and E, which fit snugly into the inside of the cartridge. The space between the two brass lugs is filled with a mixture of scrapings from some of the well-known crystals. The manufacturers of the device are reluctant to give the constituents, but good results have been obtained with mixtures of galena and silicon filings, to which has been added a slight amount of brass and nickel filings. In fact, the scrapings of any of the crystalline detectors known today may be used. It is only necessary to separate the brass lugs by a distance of about ¼ of an inch and half fill the intervening space with a mixture of scrapings. The entire unit is then sealed up tightly and in some cases exhausted by means of a vacuum pump. The detector is then connected in the circuit of an ordinary receiving tuner in the standard manner and the tube revolved by hand until a sensitive spot is located.

In order to facilitate the adjustment to a sensitive condition, a buzzer tester, one side of which is directly connected to a terminal of the detector is employed. When the buzzer is turned on, certain of the filings will cohere and thus automatically select a sensitive point of rectification. It is rather difficult to state, offhand, just how these detectors operate, but it is probable that the action is no different

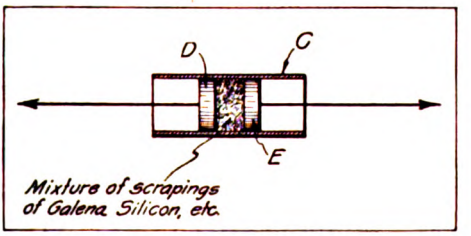


*Fig. 9*

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from that in an ordinary rectifying mineral; however, it may be that with so many filings in contact a sensitive point of rectification is more readily located than by the ordinary means. Some experimenters advance the theory that a certain form of coherence takes place between the crystals. If this is a fact it is difficult to understand how the decoherence of the filings takes place, which, as is well known, is essential for telephonic reception. Some detectors of this construction are found to have a rather low value of resistance and consequently are used in series with the condenser and the coil of wire of the secondary circuit for the usual receiving tuner. It then becomes necessary to change the usual type of stopping condenser to one of variable capacity because it is now an active element of the oscillatory circuit.

It has been found in some types of the filings detector that a rather high value of local battery current is required much in excess of that used by the usual crystals of zincite, bornite, etc. Hence good results are obtained by the use of a vacuum valve amplifier for increasing the strength of signals obtained.

It is asserted by the manufacturers that the filings detector will stand considerable jarring and will remain in adjustment under conditions that would not be possible with the ordinary types of crystals.

*(To be continued)*

## NEW DEVELOPMENTS IN AEROPLANE WIRELESS

Several English newspapers have recently reported an interview with Guglielmo Marconi, who has just returned to London from Italy with news of important developments in wireless science.

"The new developments," he says, "will not only make wireless communication in this war more efficient than ever before, but will make it more difficult for the enemy to intercept messages.

"These improvements will apply to instruments in aeroplanes and airships. Hitherto aeroplanes have been at a disadvantage with airships in wireless work, for although they were able to transmit messages, they have not been able to receive them. This was because the receiving signal was too faint to be distinguished, being drowned by the noise of the aeroplane engine. Now we have been able to strengthen the receiving signal sufficiently to enable messages to be taken."

According to a German report, the new German naval and military airships are equipped with wireless apparatus of great power. Wireless impulses are diffused and received by an aerial made of a three-millimeter phosphor bronze wire that as the airship rises is unwound from a spool to its full length of 750 feet, and that when the airship is aloft floats freely in the air. The apparatus itself is very compact; with its small dynamo it weighs 270 pounds, and has a minimum range of 120 miles. Every large aerodrome in Germany has its wireless station; those at important centers like Johannisthal, Cologne, Friedrichshafen, Frankfort, and Mannheim are very powerful. Taken together they form a continuous ring and keep German airships in constant touch with a German base.

## GERMANY AND SAN FRANCISCO IN COMMUNICATION

A newspaper report says that wireless messages originating in Germany have been picked up by the powerful government radio station on Yerba Buena Island near San Francisco, as well as commercial wireless stations on many occasions recently, according to operators at government stations.

Commercial stations along the Pacific Coast likewise have picked up Hanover messages, according to Lawrence Malarin, of the Marconi Company.

"Our station at Point Reyes has picked up many messages from Hanover, in the last few months," said Mr. Malarin. "It is unusual, as our station is not tuned to work with the German stations."

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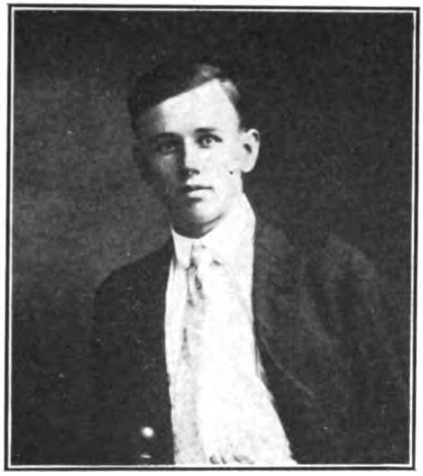
# The Sinking of the Roanoke

## A Disaster of the Pacific in Which Operator Chamberlain Lost His Life

FOR a disaster of the sea to occur without some instance of noteworthy achievement by wireless or act of bravery on the part of wireless men is somewhat unusual, and the sinking of the steamship Roanoke off the California coast on May 9, was no exception to the rule. In this disaster forty-six persons out of a total of forty-nine lost their lives. George Ernest Chamberlain, Marconi operator, sailing on his first permanent assignment, was among those who met death. Like others in the service who have died in brave performance of their duty, he left behind him fine memories of courage and zeal.



*George E. Chamberlain*

Chamberlain was assigned to the Roanoke on April 23 when she touched at San Diego, Cal., on her last northbound voyage. She steamed away from San Francisco, bound for Valparaiso, at midnight on May 8, laden with a cargo which consisted of 600 tons of dynamite, 1,300 tons of wheat and several hundred drums of gasoline and oil. At four o'clock on the morning of May 9 the yacht Benicia sighted the Roanoke sixty-five miles south of San Francisco. Captain Thomson of the Bencia reported that a heavy west-northwest sea was running, and that the wind was blowing at the rate of twenty miles an hour. Notwithstanding these conditions the steamship was standing up under wave and wind without difficulty.

Several messages were received from the vessel after she left San Francisco, the last one giving the position of the ship at eight o'clock in the morning, as ninety miles south of San Francisco. From that time until the arrival at San Luis Obispo, of one of the Roanoke's small boats containing the three sole survivors, there is a hiatus. Later another boat containing the lifeless body of one of the vessel's officers was picked up.

There is more than one report as to the manner in which the Roanoke foundered, but none throw light on just how Chamberlain met his death. The story of one survivor is to the effect that the vessel began to list heavily several hours before it sank, and preparations were made to take to the lifeboats. Several boats were swamped in the heavy sea and others caught in the davits as they were being lowered into the water.

Whether Chamberlain met his death in one of the lifeboats, or remained to find, as her captain did, his final resting place in the vessel's watery grave, on the foundering Roanoke, is a matter of conjecture. As soon as the first boat



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was picked up at San Luis Obispo, instructions were immediately flashed from all coast stations to ships at sea to search for additional boats and wreckage. There were several ships passing up and down in the vicinity of the wreck and a careful investigation was made. It was without result, however.

The Roanoke had been sailing in the passenger trade for a considerable number of years. Chamberlain was detailed on board after he had shown his mettle in filling temporary vacancies. When it was decided to send her as a freighter on her voyage to Valparaiso, Chamberlain was detailed as operator, the operator who had been in charge having asked for leave of absence.

Expressions of sympathy have been conveyed to Chamberlain's parents by officers of the Marconi Wireless Telegraph Company of America. Chamberlain, who was born in Fortuna, Cal., September 5, 1895, lived with his parents at No. 121 North Sixth street, Sawtelle, Cal. In a letter written to a friend a short time before his death he expressed the fear that he would lose his life on the Roanoke. . . . . "I don't know whether I'll ever come back," he wrote. "Don't tell . . .—not that I am afraid, but it would worry my mother."

## SPARKS

### Poem Written by George Ernest Chamberlain Shortly Before His Death

We list through the night
To our comrades afar,
On the tropical seas
Or beneath the North Star,
We flash out glad tidings—
Some of sorrow and hate,
Of a tempest arising
Or a ship warned too late.
Now we're hearing a ship
And her cries of appeal
Of the wave-wrecked reef,
That is clutching her keel.
Ah! Her set is now still;
Not a spark rends the air,
And we dream of the story
Of death and despair.
We think of a face—
He—my pal to his death;
It is hard to believe
He has breathed his last breath
He's a man among men,
E'en the Devil's defied;
He has now met his God
As the wireless men died.

# In Friendship's Name

I have learned more about wireless from THE WIRELESS AGE than any other source.—L. E. F., *New York.*

I have been reading a friend's WIRELESS AGE, and simply cannot do without it. It is excellent, and I am sure of renewing my subscription four months from now.—R. S. B., *New York.*

My subscription to THE WIRELESS AGE expired with the July issue. I have been taking it for one year and wish to say right here that I think it is the most up-to-date and covers the wireless subject the most thoroughly of any magazine published to-day. Of course the above does not amount to much with you people as you get many letters such as this every day, but nevertheless I think that there are many over the country that will back up this statement of mine.—L. K., *Oregon.*

I have received my four months' trial subscription to THE WIRELESS AGE and find it to be as you claim the *best magazine* on the wireless subject that I have ever read.—D. I. B., *Iowa.*

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# How Wireless Has Served the Sea

## Ships Disabled by Accident or Crippled by Tempest and Gale

**Part III**

THE one accident that the best of navigators cannot foresee and the finest nautical skill cannot avert, is that caused to the vessel which crosses the path of a hurricane. In one fell swoop the proudest craft has become a crippled plaything of the waves, with a broken propeller, a ruptured shaft or her steering gear awry. To many a tempest-tossed ship, whose brine-soaked and exhausted crew have been working day and night in the effort to keep a deck under their feet, the silent voice of the wireless message has come as a harbinger of help from heaven.

One may well imagine the unexpected joy of the crew on the waterlogged bark Medora, on New Year's Day, far back in 1901, when a tug came steaming out to tow them into port. The plight of the bark had been reported by the wireless operator aboard the steamship Princess Clementine. That was one of the first instances on record of wireless saving a disabled craft.

Nearly three years after in December, 1903, the passengers on a large trans-Atlantic liner, which had been disabled in mid-ocean, were cheered by the wireless messages that were interchanged with land stations, apprising friends and relatives of the safety of all on board, and telling them that the vessel was returning to the nearest port. This was the Red Star Line steamer Kroonland which on December 5, had steamed from Antwerp on her passage to New York. The Kroonland was one of the four large Red Star Line steamships that had just been equipped with the Marconi system, and was the first of the number to make use of the wireless in her distress. The weather was hazy and a gale was blowing. On the afternoon of December 8, the Kroonland communicated by marconigrams with Brow Head stating that she was then seventy-eight miles west of Fastnet, returning to Queenstown with her steam tiller smashed and her steering gear disabled. She steered her way to port with the use of her engines. And thus the wireless message demonstrated its usefulness by ending all anxiety as to the fate of the big passenger steamer and the men, women and children she carried.

The incalculable service rendered by the radio message was next demonstrated in the case of the Clyde Line steamer Arapahoe, which, in April, 1907, broke her propeller while coming up the coast from Jacksonville. At the time of the accident the vessel was in the vicinity of Winter Quarter Shoals. The weather was thick but the captain figured that the steamer Apache of the same line, bound south, must be in the neighborhood, so he began to call her by wireless. His calculations proved correct, for soon there came back the answering signal. The Apache ran down to her disabled sister ship and succeeded in passing a hawser to her. The Apache towed the Arapahoe to within thirty miles of Five Fathom Bank off the Delaware coast, where the lines parted and both vessels went ashore. Wireless distress calls were immediately sent to land, and the Iroquois rescued both vessels from their predicament.

Plunging slowly through a tremendous seas stirred up by a westerly gale, the schooner Ann J. Trainer was reported on the night of March 11, 1909, creeping up the Jersey coast at the end



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of a stout steel hawser attached to a sea-going tug. The vessel was almost dismantled, and the skipper, Captain Derrickson, and his crew were exhausted from days and nights of toil to keep the deck under them. The salvage of the Trainer was but another proof of the efficacy of wireless at sea, for it was through the exchange of messages between ship and shore that help was obtained for the stricken craft. The first news that came to shore of the plight of the schooner was when a party of fishermen ,after a hard battle with wind and wave, made a landing at Egg Harbor Life Saving Station, N. J., and told of having sighted a schooner in distress. The life savers, unfortunately, could not get their boat through the surf, but they sent word to the wireless station on the pier at Atlantic City. The wireless operators there sent out a call for help with the result that the Marconi operator on the Old Dominion liner from Norfolk for New York picked up the message. The Jamestown obtained general directions and was soon racing to the schooner's aid. As she steamed along, guided by information from shore, the operators at the respective instruments talked together, and the Atlantic City man told of the fishermen who had reported the distressed vessel and gave the steamer clearer directions to guide her on her search. Two hours later, the Marconi man on the Jamestown flashed back to Atlantic City: "We have found her."

The Trainer was sighted wallowing about in a sea that rolled her rails under and sent tons of water thundering upon her decks. Two of her masts were gone and all her upper rigging torn out. Captain Derrickson thanked the officers on the Jamestown, and signalled that he was going to stick to his vessel. He had put up his flag, Union down, to notify passing craft that he needed a tug. The Jamestown flashed this information to Atlantic City and the station there passed word on to Philadelphia. From that city word was sent to Delaware Breakwater, and the ocean-going tug Atkin Hughes started out in search of the derelict, found her and towed her to New York.

In the same month of March, the steamer City of Racine was disabled in Lake Michigan, and the wireless was instrumental in saving the lives of 200 passengers aboard her. It effected a similarly brilliant rescue on the same waterway on June 27, of the same year, when the steamer City of South Haven, of the Chicago & South Haven Steamship Company, had her rudder torn away en route from Chicago to South Haven, Mich. The vessel was then placed at the mercy of a heavy sea. Assistance was quickly obtained through wireless, and the steamer was towed to port with her 100 passengers.

In this year another accident happened to the Clyde Line steamer Arapahoe, which had been served to such good purpose by wireless two years before. On this occasion the Arapahoe was bound from New York to Charleston and Jacksonville, heavily laden and with many passengers on board. This was on August 11, 1909. The wireless station at Beaufort, N. C., received a message from the Clyde liner that she had broken her tail shaft near Diamond Shoals and was drifting helplessly. The Arapahoe at the time flashed her S O S, which was now being used in place of the C Q D as a distress signal. An hour later the steamer Huron of the Clyde Line arrived to the aid of the disabled steamer and stood by her until her rescue was effected.

The fall and winter of 1909 was one prolific of accidents to lake and coastwise steamers. On September 21 the steamer Caris of the Clyde Line, bound from New York to Wilmington, N. C., and Brunswick, Ga., with passengers and cargo, was compelled to come to anchor off Cape Hatteras after her machinery had become disabled.

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She sent out the S O S call, to which rescuing vessels responded and towed her into port. In the next month, October 13, the steamer Georgia of the Goodrich Transit Company was rendered helpless by the loss of her propeller blades in a heavy sea and high wind when off Kewaunee, Wis. A wireless message was sent out asking for assistance, in response to which a tug was dispatched from the harbor, which towed the Georgia into Kewaunee. There were two accidents in the following month, one to the steamer Alliance of the California & Oregon Coast Company, which, on November 1, lost her rudder at the entrance of Goose, Ore. Tugs were summoned by radio and the vessel was towed into port. Then, on November 22, the steamer Puritan of the Graham & Morton Transportation Company, when off Benton Harbor, Lake Michigan, in a winter gale, was disabled by breaking her steering gear, and the vessel was buffeted about in the rough seas. The steamer Benton Harbor and a tug were dispatched from Ludington, Mich., in response to the distress call which the Puritan had sent, and the disabled steamer was promptly towed into St. Joseph, Mich.

The year's record wound up with an accident to another Clyde liner during the Christmas holidays, when, on December 27, the Iroquois, while bound from New York to Jacksonville, lost her propeller just north of Frying Pan Shoals. Wireless distress calls brought responses from nine steamers, and the San Marcos of the Mallory Line towed the Iroquois, which herself had been a rescuing steamer in the past, to Charleston, S. C.

From the very beginning of the year 1910 the Marconi wireless system inaugurated a record of brilliant service to vessels disabled on lake and sea. Two sister ships of the Clyde Line again figured as rescuer and rescued on January 3, when the Algonquin, while bound from Boston to Galveston, broke her tail shaft off Cape Hatteras in a blizzard. The Apache picked up the wireless distress call, went to the assistance of the Algonquin, and towed her back to port.

Four days later, in the middle of Lake Michigan, and at night, the steamer Arizona of the Goodrich Transit Line, burst her cylinder heads, and found it impossible to make progress through the ice floes. She sent out distress calls by wireless. The steamer Indiana came to her aid and towed her to dock in Chicago.

A remarkable instance of the instrumentality of the Marconi Wireless Service in saving life occurred on February 5, when the steamer Kentucky, a wooden vessel, bound from New York to the Pacific Coast, via Cape Horn, to enter the Tacoma-Alaska service, sprang a leak off Cape Hatteras. The Marconi operator on board sent out a distress call just before the vessel sank, 210 miles east of Charleston. The steamer Alamo responded to the call and reached the spot just in time to prevent the captain and forty-six men aboard the Kentucky from going down with her. Similarly effective was the rescue of ninety-five persons from the steamer Santa Clara of the North Pacific Steamship Company, which foundered off the coast of California on April 13. The persons whose lives were saved were taken off the sinking Santa Clara by the tug Ranker, which had been summoned by the wireless distress call.

The casualties continued. It was a bad year in the shipping world. On May 9 the steamer Preston of the United Fruit Company, plying between Mobile Ala., and Central America, lost her propeller and was rendered helpless. A wireless message to Mobile notified the home office of the trouble, which was soon remedied.

Next occurred a tragedy in the middle of Lake Michigan, in which a Marconi operator, S. S. Sczpanck, lived up to the splendid traditions of the Marconi service in spending his life that others might be saved. It was on September 9 that the Pere Marquette Car Ferry No. 18 sank in the lake. Operator Sczpanck stuck to the sinking craft long enough to send out the S O S call, and then went down to his death. The call, however, was received by the Ludington wireless station and the steamer Pere Marquette

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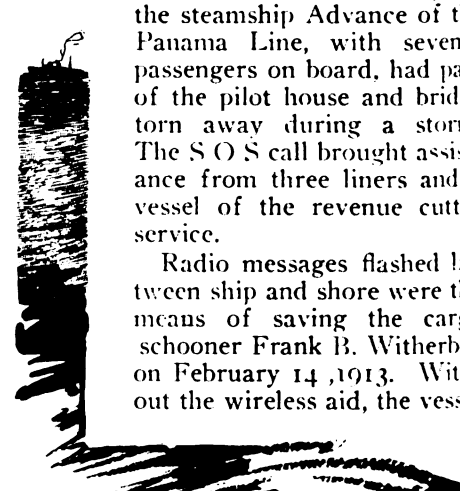
No. 17. The latter arrived at the scene of the accident in time to rescue four of the passengers and two members of the crew.

Shortly afterward another accident occurred, this time in Lake Erie, in which there was a happier ending. On September 21 the steamer Western States of the Detroit & Buffalo Steamship Company while on her eastern trip from Detroit to Buffalo, was disabled off Long Point, Canada. By means of the wireless apparatus on board, her captain was enabled to communicate with the owners, who promptly sent relief to the helpless ship.

On October 18 occurred the first instance in which the passengers and crew of a distressed dirigible airship were rescued in midocean from their craft by a steamer through the medium of wireless telegraphy. On the night of October 18 the Wellman dirigible balloon America was drifting helplessly over the Atlantic Ocean. Irwin, the wireless operator on the airship, was sending out the S O S. The lights of the dirigible were sighted from the deck of the Royal Mail steamship Trent, just about the time when Marconi Operator Ginsburg, aboard the Trent, picked up the marconigram. Communication was had from the deck of the Trent with the Morse code of signals, and after that the wireless was used in all further communication between ship and airship. Walter Wellman soon sent word to the captain of the Trent that the airship could not put her lifeboat in the water and asked the steamship to keep close. Shortly afterward, Operator Irwin, on the dirigible, informed Ginsburg, the operator on the Trent, that the airship America's crew wished to abandon the balloon. The rescue of Wellman and his men was made without mishap, and the news of the disaster to the America and the safety of her crew was flashed to shore stations 500 miles distant and was published in all the newspapers of the country.

Sea casualties were fewer in number during the year following. Wireless telegraphy, however, played a prominent part in saving life on April 11, 1911, on the steamer Western States of the Detroit & Buffalo Steamship Company, which only nine months before had met with mishap in Lake Erie. It was on June 15 that the same steamer was disabled by the blowing out of a cylinder head while in the middle of the lake, bound for Buffalo. Two vessels responded to her distress call, and all of the passengers, 200 of whom were members of the Michigan Bankers' Association, were rescued.

Wireless again was the savior of the coastwise liner Camino, which arrived at San Francisco in October, 1912, in tow of the steamship Watson, six days out from Portland, Ore., with a story of furious weather danger and disablement. The Camino had cleared from Portland with eighty passengers. Off Astoria she ran into a stiff southeast gale, eighty miles an hour in velocity. Heavy seas swept the decks and the terrified passengers gathered in the saloon, praying and weeping. Meanwhile the S O S call was being sent out continuously. The gale raged all night and at half-past five o'clock on the morning of October 19 the propeller dropped to the bottom of the sea from a broken shaft. The vessel was at this time fifteen miles off shore, with the wind carrying her farther to sea. Suddenly, to the immense relief of all on board, word was received by wireless from the steamer Watson, and in three hours that vessel was standing by, and the suspense of those on board the Camino was ended. In the same year the steamship Advance of the Panama Line, with seventy passengers on board, had part of the pilot house and bridge torn away during a storm. The S O S call brought assistance from three liners and a vessel of the revenue cutter service.



Radio messages flashed between ship and shore were the means of saving the cargo schooner Frank B. Witherbee on February 14, 1913. Without the wireless aid, the vessel

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and those on board of her inevitably would have been lost. For three weeks the gales had made a target of the three-masted schooner, which was loaded with stone. On February 14 the schooner was still in a howling gale off the New England coast, with the water rushing into her strained hull. She managed to creep within ten miles of Highland Light, where her signal of distress was sighted. A wireless appeal was flashed to Captain Broadbent of the Revenue Cutter Service. In turn, the cutter Itasca, cruising near Cape Cod, was notified by wireless and went promptly to the rescue. She not alone saved all those on board the imperilled schooner but safely towed the disabled craft into Boston Harbor.

Passengers and crew of the steamship Texas, bound from Christiania to Galveston, were battling with a severe storm on the evening of Good Friday, 1913, when suddenly the propeller was wrenched off. For a day and a night the vessel rolled helplessly in the sea, but at length the C. F. Tietgen of the Scandinavian-American Line received the wireless call for aid and came to the rescue of the distressed ship.

The steamship Riverside was wrecked and sunk off the California coast on June 19. Marconi Operator R. H. Brower sent out continuous calls for aid which were finally heard and rescuers arrived to save all on board.

In November of this year (1913) storms on the Great Lakes destroyed nineteen vessels, none of which was equipped with wireless. All those vessels which were wireless equipped, however, received warning of the coming storms and sought and found safety.

Through the heroic efforts of Marconi Wireless Operator William Davis, on board the oil tank steamship Oklahoma, in January, 1914, one-third of the crew were saved, who otherwise would have perished. The S O S call sent out by Davis reached out over miles of mountainous seas and brought rescuers to the scene after the Oklahoma broke in two about seventy-five miles south of Sandy Hook on January 4. Twenty-seven members of the crew of forty were lost when small boats were launched in a raging gale. The Spanish steamship Manuel Calvo sighted the wreck, but itself was helpless to go to the assistance of the crew. It sent the message it had received to the Marconi station at Sea Gate, however, and rescuers started on their way. But on January 5 the Hamburg-American liner Bavaria sighted the signals from the small boats and took off all the men, among whom was Davis, the Marconi operator.

The lumber schooner Yellowstone, in distress in a storm off the Pacific coast, on February 14, hailed a passing vessel and asked that a wireless call for assistance be sent out. This was done, and another lumber vessel responded and succeeded in towing the Yellowstone to San Francisco.

The account of the sinking of the steam schooner Francis H. Leggett, sixty miles south of the Columbia River, in September of this year, provides the world an example of self-sacrifice that will live long in the memories of those who record and appreciate acts of heroism on the sea. Clifton James Fleming, the young senior operator on the doomed craft, was clinging to floating wreckage when he saw a woman struggling in the water. The wreckage would not support two persons, but was sufficient to hold one above the water. Fleming, knowing that he was going to his death, deliberately relinquished his grasp and gave up his place to the woman. Harry F. Otto, the junior operator, remained on the ship so long as there was opportunity of rendering assistance, winning a place among the wireless men who have died in fulfilling their duty.

The Leggett, which was owned by the Hicks-Hauptman Navigation Company of San Francisco, was bound for that city with a full passenger list and a cargo of lumber. She cleared Gray's Harbor and ran into seas which tossed her here and there and battered her mercilessly. She arrived off the mouth of the Columbia River on September 17, and on the 18th the effects of the pounding she had received began to tell. Captain Charles Maro, com-

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mander of the vessel, realized the danger which confronted them, and took measures to protect the passengers and crew. He ordered the cargo to be jettisoned, but this measure was to no purpose, since the ship was being struck with terrific force by large waves which washed over the decks and tore open the hatch, causing water to pour into the hold. Efforts made to use the lifeboats were rendered fruitless. So soon as they struck the water they capsized and the occupants were drowned.

The Leggett, beginning to list, lurched suddenly and capsized before the majority of those on board had the opportunity to jump into the water. Alexander Farrell, of Sacramento, Cal., was on the bridge and was carried down by the suction of the ship. When he again came to the surface he was pulled to safety on a railroad tie by Operator Fleming, who had remained on board until the last and was among some thirty persons afloat on wreckage after the vessel sank. These survivors disappeared one by one until only Fleming, Charles Pullman, a member of the crew and three women were left. One of the women lost her hold on the wreckage which was keeping her afloat and was washed against Fleming. He helped her to grasp the tie, and realizing that it could not support them both, he let go and sank. Harry F. Otto, the junior Marconi operator, had been carried down by the suction of the ship.

The Marconi station at Astoria, Ore., intercepted a message containing information of the sinking of the Leggett, which had evidently been sent from a foreign cruiser to a Canadian station. The Astoria station notified all ships in the vicinity to look for survivors. Only two persons were rescued, among them being Alexander Farrell, who was picked up by the oil tanker Frank H. Buck. The steamship Beaver, which had intercepted one of the wireless messages from the Leggett, ran into the wreck and rescued the only other survivor.

Four further accidents to disabled steamships wound up the events of the year. The steamship Proteus of the Southern Pacific Steamship Company, en route to New Orleans from New York, broke her main shaft and lost her propeller. The steamship El Oriente answered her wireless distress calls and towed her safely into New Orleans. This was on October 28. On December 8 the steamship Momus sent out an S O S call when her steering gear became damaged. The tug El Ray went to her assistance in response. Three days later the steamship Centralia asked for assistance by wireless and the steamers Harvard and Bear went to her aid. On December 30 the steamship Colorado had her machinery disabled while off Little Egg Harbor, New Jersey. There was aboard a crew of thirty-five persons, but no loss of life ensued, since tugs brought the vessel in safety to New York in answer to her wireless calls.

There were numerous marine disasters in the year 1915, in which many disabled vessels were succored by the wireless service. At the very beginning of the year, the steamship Iowa was crushed in the ice of Lake Michigan, off the mouth of the Chicago

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River. Marconi Operator Keefe sent out the S O S signal and remained at his post until five minutes before the steamer sank. The vessel foundered before the rescue tugs arrived in response to the call. But all the members of the crew were fortunate enough to be able to walk safely across the ice to shore.

On January 18 another accident occurred to the steamship Camino, which had suffered so serious an accident in 1912, when she found herself helplessly adrift at sea. The Marconi operator on board sent out the S O S, which brought the Canadian Government steamer Lady Laurier and several other vessels to her rescue.

The oil tank steamship Chester, her superstructure demolished by the waves, was drifting where it pleased the seas to hurl her, on February 4. She was not equipped with wireless, but she did have among her officers one, named Waale, who holds a cargo grade wireless certificate. All of the tanker's signal lights, excepting one, having been extinguished through saturation with water, it devolved upon Waale to send out the S O S by flashlight. While the Chester's men were hoping and waiting for rescuers to appear, the American Line steamship Philadelphia was making her way, unknown either to her commander or to that of the tanker, toward the wreck. The Philadelphia reached a point to within a few miles of the Chester, so near, in fact, that the officers of the former could distinguish Waale's S O S spelled out in the darkness. On the Philadelphia were Marconi Operators Jones and Moore. The latter was summoned to the bridge to respond to the signals of Waale, and he then received the messages which told of the hopeless fight the crew of the Chester had been making against the sea. The men on the wrecked tanker were at once informed that the Philadelphia would "stand by," and soon after, the tanker's entire ship's company of thirty-three men was transferred safely to the Philadelphia.

On March 18 the steamship Santa Anna was disabled on account of boiler trouble off Kodiak Island, Alaska. The steamship Windber responded to the S O S call, and no lives were lost.

Another triumph for the Marconi service was achieved by the Marconi operators who sent out and received the news of the sinking of the Mallory Line steamship Denver, thus being instrumental in the saving of the lives of sixty-five persons. Buffeted by the seas until she was in a sinking condition, the Denver sent the S O S call broadcast over the ocean when she was in the mid-Atlantic, 1,300 miles from New York, on March 22. Despite unfavorable weather conditions, aid was at hand in less than twenty-four hours after the appeal had been flashed, and those on the distressed craft were rescued. Eighteen ships were at hand, ready to give assistance, when the rescues were effected. The Marconi operators on the ill-fated craft were Henry McKiernan, first operator, and Frederick H. Crone, his assistant.

On April 29 the Edgar H. Vance was in danger of sinking just outside of San Francisco harbor, her rudder having broken. A distress call was sent by radio and the vessel that responded brought the necessary assistance. No lives were lost.

On May 31 the steamship Seward, when thirty-five miles off Cordova, Alaska, began to list badly because of the shifting of her cargo. She sent out a wireless call, and two ships, fifty and eighty miles distant, answered immediately. The Seward was wrecked, but all on board were saved.

On August 4 the steamer Emma Angel was storm-battered and waterlogged forty-five miles southeast of the Highlands. She signalled to the Bermudian near by, which sent out a wireless distress call, to which the Seneca responded, and all on board were saved. Several weeks later the Edith of the Alaska Steamship Company, when forty miles northeast of Cape St. Elias, listed badly on account of the shifting of her cargo of copper concentrates. Her S O S call brought the necessary aid, and all on board were saved. The vessel was abandoned to her fate.

On December 21 of this year the

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steamship Minnesota, when 760 miles south of San Francisco, sent out a wireless stating that her machinery was disabled. The necessary aid was rendered by the Iroquois and the tug Dauntless, which responded promptly upon hearing the distress call. Similar assistance was rendered by means of the wireless to the steamship Shabenee, which broke her propeller off Newfoundland. Her call for assistance was answered by the steamship Muskogee and the disabled vessel was towed into St. Johns.

The casualties of the year were wound up by two accidents that occurred to the Greek Line steamship Thessaloniki. The wreck of this steamer was marked by the devotion to duty of the Marconi wireless operators on board of her, Aristotelis Vranicas, Kimon Paleologos and James Lambros. Vranicas, the chief operator, Paleologos, his assistant, and Lambros summoned rescue ships to the aid of the battered Greek craft to take off her passengers. The Thessaloniki at the time was west of the Azores in heavy weather, with her engine room flooded and her lifeboats carried away. On December 22 the S O S was sent out and was heard by the Italian steamship Stampalia, wh ch came to the scene and stood by until the pumps on the Greek ship were got working again. Then the Stampalia steamed away. On December 26 the storm broke again. The vessel's wireless was crippled but was repaired. On December 28 the Thessaloniki found herself again in distress and again sent out the S O S call. This was responded to by the steamship Florizell, the United States revenue cutter Seneca and the steamship Patris. The latter took off 215 passengers and began towing the Thessaloniki, but the hawser broke in the gale. The Thessaloniki was again left alone, and the wireless men on board were compelled to send out further calls for help. Then the steamship Perugia came and rescued the ninety members of the crew from the ill-fated vessel.

The casualties of the present year began with the rescue through the use of wireless, of the steamer Vandeggen, which was not equipped with Marconi apparatus but was observed by the steamer Muskogee displaying signals of distress. The Muskogee sent a wireless message broadcast, giving the position of the disabled steamer, which was later towed to port.

Thirty-five souls, members of the crew of the British steamer Pollentia, were rescued from the vessel through the medium of the S O S signal, while she was in distress 706 miles off Cape Race. A wireless message was received from the disabled ship at Halifax, Nova Scotia, on January 19, stating that she was in a sinking condition in latitude 36.30, longitude 35.04. The calls for help were almost immediately answered by several vessels, among them being the Giuseppe Verdi, the America, the Moncenisio, the Westerdyk and Narragansett. For four days the Giuseppe Verdi stood by, giving all the assistance possible. At no time was there any hope of saving the Pollentia, but attempts to take off the crew were deferred because of the gale and the tremendous seas. The captain and crew of thirty-five were finally rescued by boats from the Giuseppe Verdi while the Narragansett poured oil on the waves.

Marconi Operator Earl Diamond did yeoman's service on board the steamship Centralia when the ship became disabled and the aerial was carried away by heavy seas. In the midst of the tossing sea, Diamond repaired the damage and then called the S O S signal. The accident occurred on January 22 off the Columbia River. The waves washed away the deck load, broke the rudder and flooded the engine and wireless rooms. The call for assistance was answered by the steamships Governor, Adeline Smith, Yosemite, Admiral Schley, Eurana, and land stations at Marshfield and Eureka. The weather and sea finally moderated and the ship made San Francisco safely without assistance.

Two days later the oil tanker Frank H. Buck lost her rudder, 355 miles north of San Francisco. This was the same craft that had gone to the rescue of the Francis H. Leggett during September of the previous year and res-

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cued one of the two persons saved from that unfortunate vessel. The Buck, however, met with no more dangerous mishap, since the use of her wireless brought immediate aid.

The month of March produced many shipping casualties, the first of the number being an accident to the steamship Apache, which had her machinery disabled forty-five miles south of Cape Henry, and was compelled to anchor in twenty-five fathoms. In answer to her wireless message, wrecking tugs arrived and towed her to port. On the following day, March 5, the steamship Principe de Austrias foundered off Ponta Boi near Santos. She had 1,000 souls aboard at the time and in response to frantic calls for aid by wireless, the steamship Vega arrived and succeeded in rescuing most of those on board. Passengers to the number of 338 and eighty-six members of the crew were lost, however.

Wireless was the means of saving the twenty-eight members of the crew of the Norwegian ship Svaland, which had left Liverpool on February 24, bound for New York. Her masts were carried away by a storm that swept the North Atlantic and she began to drift helplessly. The coast guard cutter Seneca reported by wireless on March 27 that she had located the Svaland, dismasted and adrift, in a raging storm 235 miles southeast of Halifax. She waited until the gale had abated, and then took the disabled craft in tow.

One of the most remarkable wireless exploits of the year was that performed by L. A. Hooke, the wireless operator on the auxiliary bark Aurora of the Shackleton antarctic expedition, who sent the first tidings to the world of the plight of that vessel. The message, published on March 25, was made possible by a "freak" performance on the part of the wireless equipment of the Aurora. The message was received by the Naval Radio Station of Williamstown and the radio station at Melbourne when the ship was at least five times more distant than the normal range of her transmitting equipment.

The Aurora, which was the relief ship of the expedition, broke from her moorings in Ross Sea on May 6, 1915, and was adrift in the ice for ten months. The wireless equipment, a gift from the people of Sydney, Australia, had originally an effective transmitting radius of only 200 miles. A month before the ship started on her long drift, there were added twenty feet to the aerial masts of the Aurora. As soon as she broke away from her moorings, Hooke endeavored to get in touch with the members of the marooned party ashore, hoping that they had been able to erect the receiving set previously landed and it is just possible that the land party learned by these signals of the Aurora's ill fortune and were able to make the earliest possible provision against an unexpected twelve months on land.

On June 1, 1915, Hooke, basing his hopes on the fleeting possibilities of abnormal wireless conditions, commenced to call Australia, but without success. He attributed his total failure to electrical phenomena peculiar to the polar regions, and he made exhaustive experiments with all sorts of makeshifts in the hope of getting definite results. It is well, perhaps, for Hooke and his fellow adventurers that they did not know the real reason for their non-success, as the hopes of relief which buoyed them up until their return might have been shattered.

In the first place, the Commonwealth of Australia, in the interests of economy, had recalled the staff of the wireless station at Macquarie Island. This removed the first possibility of intercommunication with the little party drifting in the antarctic ice. Secondly owing to military reasons, the transmitting apparatus at Awarua had been transported to a more distant place, so that had it been possible for the Aurora, by a combination of favorable circumstances, to send distress signals as far as New Zealand, she would not have received any reply.

Hooke, however, stuck to his post. It was on July 22, 1915, that the Aurora was terribly crushed in the ice. The vessel was then 100 miles from land and 500 miles from the nearest food depot. Hooke again overhauled his apparatus, even to the extent of

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lowering and re-erecting his masts, in the hope that by doing so he might help those on shore and his fellows on what appeared to be a doomed ship. Night after night he sat in his cabin with the telephone receivers strapped around his head, straining to catch sounds which would tell of the world's knowledge of their fate and efforts at rescue. Twice he heard faint signals, on August 17 and 26, but they were unintelligible.

Then there came the blizzard. On September 5, 1915, the Aurora was dismasted, the wireless aerial going with the débris. Twice were new antennae devised by linking up the mainmast with ice hummocks, but Macquarie Island remained silent—no one had been left to listen. At the end of February, 1916, with the ice breaking, the Aurora was freed to drift with her broken rudder. But the wireless operator's story now changes from sadness to joy. On March 25, with a quadruple aerial eighty feet above deck, he succeeded in obtaining definite signals from stations in Tasmania and New Zealand, 900 miles distant. Then followed the message which startled the globe. This message was transmitted 900 miles with an apparatus normally suitable for about 200 miles radius ,and eclipsed for a day at least the interest in the great world war. Hooke admits that navigation was greatly assisted on the return journey by the time and other signals received by him from the New Zealand wireless stations.

*(To be concluded)*

## AN INTERESTING NEW BOOK FOR TELEGRAPHERS

Jeff W. Hayes, the well-known old-timer and author, has just brought out an interesting and unique volume of telegraphic stories, which no doubt will meet with a hearty reception in the ranks.

It is some years since a book of this character made its appearance, and the fact that such books do appear once in a great while is evidence that operators have not yet lost their appreciation of telegraphic literature of the lighter vein.

It has the unique distinction of being at once personal and impersonal. There are many pages containing facsimile reproductions of the signatures of officials, managers, operators and other employees in many of the large offices in the country and of other persons who were formerly in the telegraph service. This feature of the book gives it a distinctive and personal character, and it is certainly interesting and "catching." Throughout the pages are scattered half tone portraits of many well-known old-timers.

The stories are, in the main, new and relate to Western life and experiences, many of the contributors being well known to the telegraph fraternity and acknowledged reputation as writers. Interspersed throughout the book are several poems which will appeal to those of a poetic nature.

The autographs fasten the attention of the reader and recall many pleasant memories and experiences over the wire in years gone by. Many of the names are familiar and make a character study of deep interest.

The price of the book is $2.50 per copy and copies may be obtained by addressing J. W. Hayes, 95 West Maumee street, St. Adrian, Mich.

## FORT RILEY STATION CLOSED

Because of the small force now stationed at Fort Riley, Kans., the wireless station at the post has been closed for the present. Private Henderson, first class, signal corps, who has been on duty at the station, has been ordered to Fort Sam Houston, Tex., for duty. The wireless has been used extensively in the past for transmitting and receiving orders between Fort Riley and Fort Leavenworth and other nearby posts, and it will be reopened for operation when troops are returned for permanent station.

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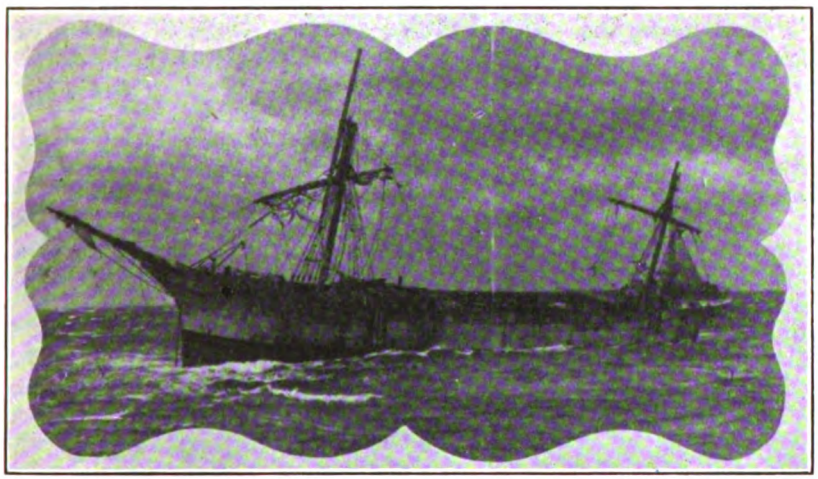
# The Guards of the Sea Lanes

## Battling With Storms and Ice On the Vessels of the North Atlantic Patrol

WINTER has broken on the Grand Banks. The wind that blows across the sea before the dawn has lost its merciless cold and the northward flying gulls, bound for their Labrador rookeries, scream that summer is at hand. To the wireless men on the revenue cutters patrolling the sea lanes these signs have considerable meaning—they are harbingers of days marked by pleasant cruising from port to port, regattas or other aquatic sports serving to vary the life aboard ship. But as summer wanes and autumn comes on the yachts and motor boats are towed into their havens, double reefs are taken in the sails of the small fishing schooners as they skim the lead gray seas, and winter descends in the form of a howling northeaster. Then the men on the revenue cutters cast aside their summer clothes and bring out their oilskins and reefers for the more irksome work of the North Atlantic patrol that guards the travelers on the sea lanes against the mischance of wreck and storm and the peril of floating ice or drifting derelict is about to begin.

Stanch steel steamers, usually schooner-rigged and somewhat larger than a good-sized steam yacht, are employed as patrol vessels. They are capable of standing up against the heaviest kind of weather, for if the wireless brings word that a craft is in distress they must be prepared to put to sea, regardless of wind or wave.



*The dismasted Svaland as the revenue cutter Seneca found her*

The discipline and life on board are in all essentials the same as in the Navy, the regulations applying of course to the wireless men Mounted on the cutters are a few handy rapid-firers, used for the most part in knocking to pieces parts of wrecked vessels that might stove in the bows of some steamship. Boat drills, too, are of the liveliest, for any day a crew may be called upon to put over side in small boats during a shrieking gale when a blunder means almost certain death in ice-cold water.

Naturally, great dependence is placed on the radio equipments of the revenue cutters and the men who operate them,



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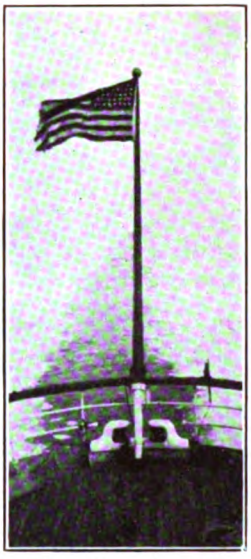
for it is of vital importance that communication be maintained, even though the seas are threatening to deal the patrol craft a death blow. The cutters use several wave-lengths—300, 600, 750, and 1,000 meters. The sets are of Marconi or composite types.

A typical winter cruise of a cutter was recently reported by Captain Commandant E. P. Bertholf, of the Seneca.

"The Seneca," he relates, "sailed from New York on February 19 to take up the duty of ice observation on the Grand Banks of Newfoundland. We ran to the eastward on the back of a strong westerly gale and arrived at the tail of the Bank on February 24.



*Ploughing through the ice fields*

"The Seneca's course was then set to the northward along the eastern edge of the Grand Bank and a sharp lookout for ice was maintained, as the steamer Brindilla had reported field ice in lat. 48 deg. 00 min. N., lon. 49 deg. 28 min. W., and later in lat. 46 deg. 55 min. N., lon. 51 deg. 37 min. W. At noon, 25th, Seneca was in lat. 45 deg. 54 min. N., lon. 50 deg. 18 min. W., and no ice in sight. Set course NW., passing twenty miles south of Virgin Rock and running through streaks of soft field ice early on the morning of the 26th. At 10 a. m., 26th, in lat. 46 deg. 15 min. N., lon. 53 deg. 10 min. W., the ice becoming so thick and heavy that the Seneca made very slow progress through it, and Cape Race radio station having informed me that the ice was packed close against the coast of Newfoundland, I turned to the southwest and worked out to the southern edge of the ice and then along it to the westward. At 3 p. m. reached the western limit of the ice, then stood along the edge to the northward. The night of the 26th was foggy and moderate SE. gale and Seneca was running through patches of soft field ice until 1 a. m. of the 27th."

Captain Bertholf put into Halifax for coal on March 12. After a short stay the cutter put out to sea again and on March 22 she received a call from Sable Island to the effect that the Norse bark Svaland had been partly dismasted and, although the Swedish tramp Murjek was standing by, the damaged vessel needed immediate aid. The revenue cutter searched the Banks for four days before she picked up the two ships.

By this time the Svaland was rolling in the trough of the sea with her mainmast overside and her decks littered with wreckage. The Murjek had attempted to tow her, but without success, the seas having parted the hawsers each time they were attached to the distressed craft. The waves were running so high that the Seneca's captain decided to postpone the launching of a boat until they had moderated, and, after attempting to pass a line with a shoulder-gun, he stood by for the night. Meanwhile the Murjek had steamed toward Kirkwall.

For two days the Seneca and the Svaland lay together, drifting before the storm, for it was impossible to navigate the cutter under steam more than a few minutes at a time, without risk of losing sight of the Svaland. At last the captain of the Svaland signaled that he as short of provisions and, the gale having lost

*Gun crew destroying a derelict*

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some of its force, the Seneca's lifeboats were launched. Nineteen men—one suffering from a broken knee cap—were brought to the Seneca, and a hawser was extended from the revenue cutter to the bark. Five men remained on the wreck to steer her on her long tow to Halifax—a distance of more than 400 miles.

*The Seneca's mascots—two Newfoundland pups*

This is only one instance of timely service by a patrol vessel and her men. There are many others, some of which have been chronicled at various times. But there are no speeches and no heroics—it's all in the day's work—and the wireless man does his share.

## LONG DISTANCE RECORDS ON THE PACIFIC

Two interesting long distance records have been made recently on the Pacific Ocean. The China Mail Company's steamship China, the only passenger and freight steamship in the trans-Pacific trade flying the American flag, was in communication with the Marconi Hillcrest (Cal.) station from the day she left San Francisco until she was 2,800 miles away from that port. While the steamship J. A. Moffett, returning to San Francisco from the Orient, was 2,600 miles from the Pacific Coast, the night operator at the Hillcrest station picked her up. Both the China and the Moffett are equipped with the new Marconi quenched gap sets.

## NEW SUPERVISOR AT SAYVILLE

The wireless station at Sayville, L. I., which is under guard of the United States naval authorities, has a new supervisor, Lieutenant A. A. Merrick, from the battleship Michigan. He succeeds Lieutenant Windsor, who has been in charge since the United States assumed charge of the station. Lieutenant Windsor will go to Honolulu.

Reports that the guard of marines at the station was to be increased have been denied. There are sixteen men at the station at present.

## DR. AUSTIN DISCUSSES DARIEN EXPERIMENTS

At a meeting of the Institute of Radio Engineers, held recently at the Engineering Societies' Building, No. 33 West Thirty-ninth street, New York City, Dr. Louis W. Austin read a paper on the "Experiments at the United States Naval Radio Station at Darien, Canal Zone." He discussed this investigation, as well as the station's work with reference to the effect and reduction of strays. A second paper, entitled "Some Small Direct Current Sets," was read by Bowden Washington.

## WIRELESS AIDS THE POLICE

A lively exchange of wireless messages between the steamship Plymouth of the Fall Fiver Line and the Cambridge, Mass., police, resulted in the arrest recently of two brothers. They were taken into custody when the boat arrived at her North River pier, New York City.

A third passenger on the Plymouth overheard a conversation between the brothers and carried it to the Captain. A wireless message to the Cambridge authorities brought the response that the two men were wanted on the charge of swindling a confectioner out of $1,400 which he was induced to invest in a proposed knitting mill.

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# With the Amateurs

Washington is to be headquarters of a woman's radio club, with branches in several large cities, notably Boston. This is one of the first organizations showing the permanence of the National Service School's incentive to the women of the country to develop along new lines.

First intimation of this radio club was given by Mrs. Alexander Sharp, Sr., who is in charge of the volunteer instruction section of the woman's preparedness camp, working in co-operation with the Red Cross instruction courses in first aid, dietetics, home care of the sick, etc. Mrs. Sharp has been working since February on the organization of this instruction school. She has had as her chief aid Miss Sophy P. Casey, who is an expert chauffeur.

The course of instruction of which Mrs Sharp is in charge includes plain and wireless telegraphy, signaling by wig-wag, semaphore and heliograph. All of these classes are under expert service instructors and women who are professionals in their particular lines.

The wireless classes during the first course were in charge of A. A. Penland, electrician of the first class, who was recalled on account of sickness. He has been succeeded by H. L. Pitts, electrician of the first class from the President's yacht, the Mayflower, assisted by C. E. Schneider, from the Arlington radio station. An advanced class has been started with a dozen young women who are sending and receiving about eighteen words a minute. The signaling is in charge of Chief Quartermasters Walter J. Fanger and Earl D. Shipp, both petty officers of the navy.

The telegraphy classes are in charge of B. J. Beal, who has been instructing operators for more than thirty years. There are now more than thirty in his classes. The advanced class can now send and receive entire messages and the beginners can most of them send and receive a ten-word sentence.

All of the twenty-four men who have been graduated from the Y. M. C. A. wireless school at Seattle, Wash., this spring have positions and have received first-grade licenses from the government, according to George A. Mead, head of the school. Opportunities for employment in the wireless field are excellent, Mr. Mead says.

W. F. Lachelt passed the examination with a perfect grade. Others who have graduated and obtained positions are L. M. Runge, William Hoferkorn, H. L. Sherwood, E. Emanuel, George Comstock, Frank Hartman, E. V. Wampler, J. R. Moore, J. M. Hill, A. W. Johnson, J. W. James, Lynn B. Drury, C. E. Baker, J. S. Knowles, Harold Birkland, W. F. Good, Charles Morenus, Bart Mignerney, W. E. Price, M. Valentine, H. M. Currie, J. A. Johnson and A. L. Wollaston.

The demand is so great for operators that a new class in wireless is being organized for the summer. More than 125 students have been graduated from the wireless school of the Y. M. C. A. in the last two years, and, according to Mr. Mead, none of them have had any trouble in securing employment in wireless work.

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Dr. John Stone Stone, member of the Institute of Radio Engineers, in an address before sixty prominent amateur radio experimenters and inventors at Columbia University on the evening of May 12, urged them to aid the society in appealing to Congress to revise the radio laws of the country. He said the institute had named a committee to investigate wave-length regulations and formulate a revision of the law to meet present and future requirements, especially as regards experiments.

Dr. Stone said radio science was going through a development period similar to that through which telephony passed years ago, and that had the latter been restricted by such regulations as are im-

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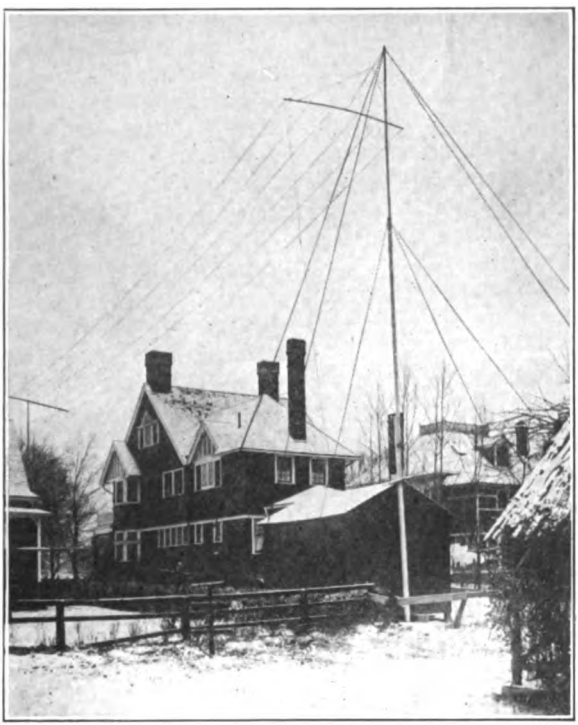
posed on radio communication the obstacles never would have been overcome.

Students of the High School of Commerce in Omaha, Neb., who are interested in wireless telegraph have installed a wireless station at the school and are operating every day. The aerial has been strung from the water tower of the Omaha Van and Storage Company to the top of the telegraph annex of the school, with the result that sufficient spark is obtained to "work" with Graceland College at Lamont, Ia., 110 miles away, and Sioux City, 120 miles away.

One of the most interesting meetings held since its organization was the weekly session of the New London Radio Club in the Y. M. C. A. building on the evening of May 23. Two speakers from New Britain, who were to have been present, disappointed the boys at the last minute, but this did not dampen the enthusiasm of the youthful operators. The meeting was the last of the weekly sessions to be held until fall.



*In this photograph is shown the aerial in the rear of Hiram Percy Maxim's home in Hartford, Conn. Mr. Maxim has received messages from many distant points*

The club voted to hold a meeting and banquet in their rooms on Friday, June 2, as the culmination of the first quarter's work. A committee composed of Herbert Scaplen, Frank Mallen, Fred Ackley, Paul Tilden and Roland Starr was appointed to make the arrangements.

A series of nineteen lessons has been offered the Radio club with instructions by an operator from the local naval base. Acors Boss, Perry Stone and William Krauth were appointed to take the matter under advisement and report.

A membership campaign for the purpose of enrolling all amateur wireless operators in the city, is being conducted by the Wireless Amateurs' Club, of New Orleans, with headquarters at No. 1024 Marigny street.

To hear the human voice transmitted by the wireless telephone was the privilege of Iowa University wireless operators recently. A message was sent from Arlington, Va., to Key West, Fla., as a test, and the Hawkeye operators caught it although they could not distinguish the words.

Saturday and Sunday, May 6 and 7, were busy times for the members of the New Hampshire Radio Defense League, with continuous service at the Central station on Arlington street, Manchester, from 4 o'clock Saturday noon, until Sunday noon, the regular meeting of the league Saturday night and field section drill Sunday morning.

Beginning Saturday afternoon at 4 o'clock, five operators of the club kept watch at the central station listening for signals connected with the test of the United States navy radio stations and

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telegraph and telephone communications.

From the standpoint of radio communication the test, so far as the local club was concerned, was not a success. While Chief Operator W. H. Hitchcock, Lieut. G. G. Starket, Sergt. R. H. Worral and Operators J. T. Webber and J. D. Valliere relieved each other in two hour tricks during the afternoon, night and morning, static or atmospheric conditions greatly hindered the work of reading the signals of the different naval stations.

At the meeting of the league Saturday evening routine business was transacted.

Sunday morning at 10 o'clock, the field section assembled under Lieut. Starkey and marched to the central station where a short address was given to the members of the section by Chief Operator Hitchcock on the purpose of the organization and on discipline. From the central station, the section marched to Derryfield park where the field radio drill was given, followed by formation drills.

While this was the first drill by the section, remarkable time was made in erecting the station. In twelve minutes from the time the section left the Arlington street station, the field operators were working with the chief operator at the central station. The actual time of erection after the section had reached the park, was four minutes.

The section made up Sunday was as follows: Lieut. G. G. Starkey; Sergts. R. H. Worrall, Thomas Smith; Corp. Mark Mordecai and Private Julian T. Webber, operators; Corp. R. A. Nixon, Privates Ernest Parker and G. R. Durgin, mast men; Frederick Scheer, Wallace Macaulay, J. D. Valliere and Walter E. Moulton, aerial men; Nelson Rackliffe, C. W. Phillips, Harry Foster and Archie Thomas, counterpoise men.

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Wireless Operator Harold Warren was on duty on the afternoon of May 7 at the Y. M. C. A. in Asbury Park, N. J., and heard distinctly the conversation between Secretary Daniels and Captain Chandler, of the New Hampshire, as did a number of friends that were called in.

Secretary Daniels' order to Captain Chandler was to return to the mouth of the Potomac river and participate in tests which were held with the Annapolis naval acadamy.

United States Radio Inspector Dillon said recently, the fact that the district office was to be removed to Chicago brought in forty new applicants for amateur wireless operators' licenses in a single week.

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G. W. Alves, wireless operator on the submarine D-3, stationed at the local naval yard, as the speaker at the regular meeting of the New London Radio Club, of New London, Conn., held in the club rooms in the Y. M. C. A. building recently. Mr. Alves kept the attention of his nineteen listeners during his talk on wireless operation in war time on the undersea ships.

The club has had a new sending set installed in its rooms and is now planning a trip to New York where the principal wireless stations will be visited.

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On May 3 a free lecture on wireless telegraphy was given in the lecture room of the Y. M. C. A. of Stamford, Conn. H. Berel, V. A. Hendrickson and Leonard H. Marshall, all graduates of the New York Berel School of Telegraphy participated in the demonstration and lecture. At the end of the course, first grade graduation certificates were granted to successful students and first grade amateur certificates to amateurs.

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Bushwick Battalion, of Brooklyn, officially the Twelfth Regiment of the United States Boy Scouts, has received permission from the New York Board of Education to install a wireless station at its headquarters, Public School No. 70, Patchen avenue and Macon streets, Brooklyn. Captain Walter C. Parker will be in charge of the radio corps, assisted by four wireless operators. Daily communication will be maintained with Arlington, Va.

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The members of the physics classes of the Hartford High School saw the high school wireless outfit in operation on May 13. E. Hart, formerly operator at the Boston navy yard, was on hand, assisted by Owen Protheroe, of the junior class. He told the members of the fundamental workings of the wireless. Messages were then sent to and received from the Brook-

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lyn navy yard and other stations. The time and weather were received from Arlington, Va., and the press news from Cape Cod.

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Miss Charlotte Baylies, of Boston, Mass., has been awarded an amateur's wireless license of the first class by the United States government. For the two weeks she has attended the "Women's Plattsburg" at Chevy Chase, near Washington, D. C., and it was there that her prowess as a wireless operator was recognized by Uncle Sam. She is the sixth woman in the United States ever to have merited this distinction.

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The Technology Wireless Society, of Boston, Mass., has found that it will be able to take an active part in the celebration when the new buildings are dedicated. Up to a short time ago the club had planned to merely set up its apparatus for purposes of exhibition. Investigations have revealed the possibility of having an entire station in active operation by June 13. The Marconi Wireless Telegraph Company has offered the coöperation of its Boston station during this period, and a license has been obtained from Radio Inspector Gawler. As a result, Technology will be able to send messages to all parts of the world, and to tell its alumni everywhere about what is happening at the new site.

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At a recent meeting of the E. T. C. Radio Club, of Jersey City, the following officers were elected: Carl Schultz, president; Fred. Doran, vice president; Lincoln Daub, secretary; William Wall, treasurer, and Clarence Maves, instructor and electrician. Alexander West was elected as an honorary member. A committee consisting of Harry Reich and William Scully was appointed to draw up a constitution and by-laws. Its headquarters are located at the Young Men's Christian Association.

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Troop 15, Boy Scouts, of Rochester, N. Y., presented a play, "Won by Wireless," on May 19 at Brick Church Institute. In the cast were Dean Shedd, Harvey Morgan, Nelson Wilmot, Arthur Sutherland, Paul Whipple, Edmund Miller and Elwood Harber.

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An appropriation of $50 for the installation of a complete wireless telegraph outfit at the Colorado Springs High School was granted by the Board of Education at its regular monthly meeting, held in the board offices May 3. It is thought probable that different commercial bodies may be asked to contribute toward the erection of the outfit.

---

Ralph Krows gave an interesting talk on wireless telegraphy to the boys of the University district at the University Branch Library, Seattle, Wash., on the evening of May 26. A model wireless apparatus was on exhibition and Krows performed a number of experiments.

Two other talks were given on successive Wednesdays at the same place and dealt with other uses of electricity, such as the telephone and the dictaphone. These talks were open to the public and free.

On April 28, Philip D. Naugle gave a talk on radio-telegraphy at the Central Library, Fourth avenue and Madison street. The talk was for men and boys who have some practical knowledge of the wireless telegraph and was naturally more advanced than the talks for boys given by Krows.

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About twenty men and boys attended the opening of the wireless school in the Y. M. C. A. at Stamford, Conn., on May 8, under the supervision of V. A. Hendrickson and L. H. Marshall.

Two sets of aerials will be installed on the roof of the building, one with a range for the State and the other with a range to San Diego, Cal. A number of Boy Scouts have signed for the course, and will start their studies shortly.

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Farrell Young, sixteen years old, a boy of Pocatello, Idaho, has perfected a wireless apparatus that has range sufficient to catch messages sent out by ships at sea on the Pacific. The young man has repeatedly communicated with Salt Lake and San Francisco. The station was built by Farrell himself at a cost of approximately $100.

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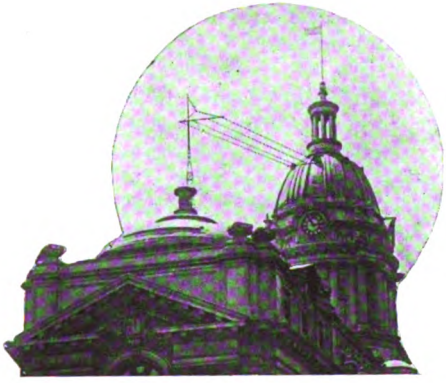
# Wireless for

## How the New Yor for the Detection Crime, Quelling R and Property in ing for Defens

*Sergeant Charles E. Pearce, in charge of the police wireless*



*The aerial on the Headquarters building*

### *WIRELESS BAGS BURGLARS*

*The wireless equipped patrol wagon, of the West 100th street police station, demonstrated its utility in a remarkable fashion early this morning. A portable radio set has been installed on this wagon, the current to operate it being supplied by the patrol wagon motor. The patrol wagon was just returning from the Men's Night Court, when Wireless Operator Jones picked up a radio message that was being flashed to the police stations on the Upper West Side from the wireless branch of Police Headquarters. The message stated that an amateur wireless operator, who lives opposite the Monumental Apartment House on Riverside Drive, had noticed burglars operating in an apartment on the top floor of the building. The amateur at once flashed the news out over the city by radio, the message being first picked up by the Senior Night Operator at Police Headquarters.*

*When Operator Jones picked up the warning, the West 100th street station's patrol wagon was within three blocks of the Monumental Apartments. It took the wireless equipped patrol wagon just one minute and a half to reach the building, and five minutes later the burglars had been bagged, handcuffed, and were on their way to the station.*

(Clipping from a New York morning newspaper, 1917.)

WIRELESS telegraphy will henceforth be an important factor in the detection and punishment of crime in New York City; in the quelling of riots or other disturbances; in the handling of unruly crowds, or large concourses of people; in the protection of life and property in the five boroughs of New York City, and on the two rivers and the bays that wash its shores. Radio, in fact, is now an adjunct in the maintenance of order and the preservation of safety in the metropolis of the United States.

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# he Police

## partment is Providing Punishment of Protecting Life City and Train- the Nation

*RIOTERS QUELLED BY RADIO*

*Flynn, senior operator at the wireless branch of the Police Department Telegraph Bureau, Manhattan Headquarters, 6:40 P. M., received radio message from Operator Herman, Bronx Headquarters, that strikers have taken possession of the Bathgate Brewing Company's plant.*

*Bronx Headquarters, wireless branch, 7:10 P. M.:—Rioters have destroyed all telephone and telegraph connections within a radius of twenty blocks. Police Booth at East 207th street has been wrecked. Radio messages have been flashed to all police stations in the Bronx, calling out the reserves.*

*Manhattan Headquarters, wireless branch, 7:15 P. M.:—Mounted Squad, West Sixty-sixth street, instructed by wireless, is on its way to the scene of the trouble.*

*Manhattan Headquarters, wireless branch, 9:05 P. M.:—Riotous disturbances at Bathgate Brewing Company quelled. Police have taken charge of the plant. Twenty men arrested. Twelve men injured. Ambulances summoned by radio from Fordham and Harlem Hospitals and injured men removed there.*

(Page from a Police Station blotter, New York, 1917.)

*MUTINEERS AND RIVER PIRATES WORSTED BY WIRELESS*

*Police Headquarters, Borough of Richmond, Borough Hall, Tompkinsville, Staten Island, New York:—*

*"Ten minutes after midnight, the operator in our wireless station received a flash from the Marconi operator aboard the India merchantman, Bombayan, anchored off Bedloe's Island, New York Harbor, reporting that a mutiny had broken out among the Lascar crew and the ship's officers had been overpowered. The Marconi man had barricaded himself in the wireless room, and stated that the mutineers were trying to break down the cabin door.*

*"Our operator flashed out a call for the police patrol steamer Patrol, and received a radio reply from her a few minutes later, just as she was entering East River. We reported the situation to the Patrol, which vessel said she would make full speed to the Bombayan, and on her way would ask the Old Slip Station for police reserves to be sent out to her aid.*

*"At one o'clock this morning we received a radio from the Patrol, reporting that she had found river pirates cooperating with the Lascar crew. Six chests of tea had been thrown overboard by the Lascars, and the pirates were loading them aboard their launch. Shots were exchanged between the Patrol and the launch, which was soon in a sinking condition. The river pirates then surrendered, and were taken on board the Patrol.*

*"At one-thirty this morning we received further word from the Patrol. She had been joined by a United States Revenue Cutter, bearing police reserves from Old Slip. The policemen from the two craft boarded the Bombayan. The Lascars put up a stiff fight, but after four of them had been wounded, they gave themselves up. The ship's officers and the wireless operator were liberated."*

(Report submitted in the year 1917 by marconigram from Richmond Borough Police Headquarters to Manhattan Borough Police Headquarters.)

This innovation is a result of the programme of "Preparedness in the Police Department" inaugurated by Commissioner Arthur Woods, of the New York Department of Police. In order that the department of which he is the head might cope with any eventuality that may arise in the life of the city, Commissioner Woods appointed a "Preparedness Committee," composed of the various inspectors of the department. These were instructed to consider and recommend the most modern and scientific applications

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in the conduct of the Metropolitan police, in order that in times of emergency New York's police force could immediately and efficiently co-operate with the naval and military authorities in the event of serious disturbance and danger to the public life.

One of the immediate results of the recommendations of this Committee of Inspectors is the fact that 3,000 members of New York's police force are now obtaining, in squads of 300 men at a time, courses of military instruction in camps at Fort Wadsworth, Staten Island. The next step was the inauguration of a wireless telegraphy department at Police Headquarters, which is the beginning of the adaptation of wireless telegraphy to every branch of the police service.

Application has already been made to the Federal authorities for a license, and by the time these lines are in type, Police Headquarters on Manhattan Island will have become a licensed wireless telegraph station. An aerial is already installed on the northern end of the Police Headquarters building, with a thirty-five foot mast and an elevation of 180 feet. The aerial has a stretch of about 100 feet, being connected with the gilded dome of the structure's tower. A 1 k.w. quenched spark gap Marconi wireless apparatus is now in operation on the fifth floor of the building at headquarters. A photograph accompanying this article shows the apparatus clearly.

Furthermore, a school for the training of policemen in the art of radio telegraphy is now being conducted on the third floor at Headquarters. The previous activities of all the thousands of policemen in New York's police force have been carefully investigated, and all those who have had experience in telegraphy have been selected to attend the classes of the wireless telegraphy school.

But the scheme adopted by Commissioner Woods has been even more far-sighted than this. There are in New York City from 500 to 600 licensed amateur wireless telegraphers, and the co-operation of these amateurs has been solicited by the Department in the use of the radio message as a protection to the city. The services of these amateurs have been obtained at such points where their co-operation may be needed in emergencies. Officials of the Department pay a warm tribute to the enthusiasm and public spirit of these amateurs, who have willingly volunteered their services in co-operating with the Police Department in any time of need.

So much for what has already been accomplished.

The program for the future in the adaptation of radio to the Police Department is one of a most far-reaching character, embracing the application of the new art to nearly every one of the activities of the Department. The next step to be taken is the installation of official branches of wireless telegraphy in the police headquarters of the other four boroughs of New York City, thus including the Boroughs of Brooklyn, Queens, the Bronx and Richmond. This is to be followed by the installation of wireless stations in each of the sixteen Inspection Districts of the New York Police Department, and eventually it is intended to have a wireless emergency outfit in each of the eighty-five police stations in Greater New York.

Nor does the plan for the adaptation of wireless in the Police Department end here. It is the desire of officials of the Department to adopt portable wireless sets for use in other emergencies; to have wireless installation on the steamer Patrol of the New York police harbor patrol, under the jurisdiction of the Harbor Police. They are considering also the adoption of a portable wireless set that may be placed on the patrol wagons, the current to operate which may be generated from the patrol wagon motors. And as a further aid in the instruction of the members of the Department in wireless and its many uses, it is hoped that a wireless station may be installed at the military training camp of New York's police at Fort Wadsworth, so that communications and instructions may be interchanged in the course of military training designed for the 3,000 men of the

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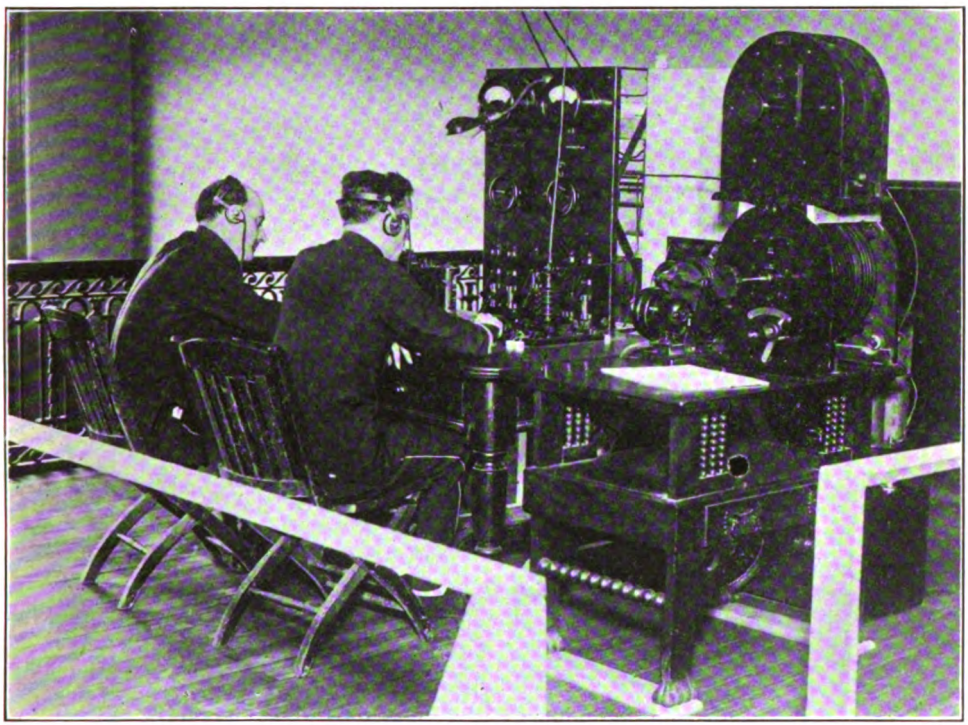
Department during the twenty weeks of the life of the encampment.

A visit to Police Headquarters is sufficient to convince anyone of the earnestness with which the Department is pursuing the program for preparedness. In the office of Chief Inspector Max F. Schmittberger, two huge maps are spread upon the walls, one of Manhattan and the other of Brooklyn. Upon these maps are being pinned miniature representations of all the important public service buildings and stations in the city, which are vital to the economic life of the metropolis, and must be protected in case of disturbance or danger. Miniature gas tanks protrude from the maps, indicating the locations of the gashouses of the city. The city's entire system of water supply, gas and electricity is outlined in relief, the buildings being shown in miniature of the pumping stations, and gate houses; also the high pressure pumping stations of the Fire Department; the armories, the bridges and buildings of the Dock Department. Also the power houses in every part of the city that might be endangered in the event of public disturbance. Beside the most important of these buildings are pinned little towers, topped with wire antennae. These are the licensed stations of amateur wireless operators, whose co-operation has been sought and obtained by the Department.



*The Marconi 1 k. w. 500 cycle quenched spark gap set in operation at Police Headquarters. The call letters of the station are 2-Z.A*

"Yes, we are Johnny-on-the-spot," said Chief Inspector Schmittberger. "Ours is the first Police Department, not only in the United States, but in the world, that has adopted the wireless service in the conduct of its activities. There is not a power house or recreation pier, not an important building devoted to public life and public service, or where throngs of New York citizens gather, that is not being covered by our proposed scheme of protective service. And all such build-

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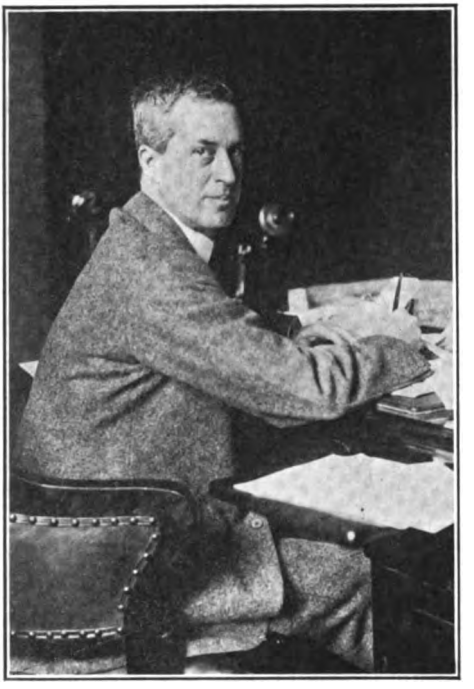

*Commissioner Arthur Woods*

ings will be under the protection of the Department in the event of any emergency that endangers them or their vicinity."

The Chief Inspector spoke highly of the licensed wireless amateurs who have joined the Department in the interests of home defense and order. Of the 500 to 600 in the city, said the Chief Inspector, a list of about 200 was first made out from the Government records, and this number was scaled down to sixty-four, as a limit for the needs of a preliminary organization. At the present time, he said, from thirteen to fourteen are now listed by the Department as aids in emergency. This first list has been made up of those licensed amateurs whose aerials are situated in the districts of the city where defense is of the most urgent necessity.

The wireless telegraphy innovation is at the present time a branch of the Telegraph Bureau of the Police Department, of which Inspector Michael R. Brennan is Superintendent. The wireless branch is in charge of Sergeant Charles E. Pearce, who is a radio operator of the commercial first grade—in fact, the only licensed wireless operator in the Police Department at the present time. Sergeant Pearce is a radio enthusiast, and has followed the art of wireless for the last six years. The Sergeant's hobby was so well known in the Department, that when the preparedness movement was inaugurated, his advice was sought, as that of a practical policeman, as to its adaptability to departmental work. The sergeant made a series of suggestions, which were taken up for consideration by the Preparedness Committee of Inspectors. They finally sent for Sergeant Pearce and appointed to him the task of developing that branch of the service for the Police Department. It was realized from the very beginning that the wireless system of communication should be placed in working order as soon as possible for use in case the departmental wires were put out of commission through any cause whatever. It was Sergeant Pearce who installed the wireless apparatus in the headquarters building, and he also constructed the aerial on the headquarters' roof, and built a light, strong, wooden mast of his own design, one which he thought best calculated to meet the needs of the occasion.

The necessity for a school of wireless instruction then came up, and Pearce was selected as the one man in the Department fitted to outline a course and initiate a corps of selected men to the art. The sergeant is himself an old railroad telegrapher, having been engaged in that capacity years ago on the Long Island Railroad, before he joined the Police Department. The instructions of Commissioner Woods were carried out in selecting the men most available to make up the initial class in wireless telegraphy, and fifteen men were selected, three of whom are lieutenants and twelve patrolmen. Each of these men is a former railroad, press or commercial telegraph operator.

"They are all rattling good operators," was the eulogium of the Sergeant when he spoke of the members of his class. "And I can assure you that they are all very enthusiastic about wireless. A telegrapher isn't apt to forget his old craft, no matter how long he has ceased to carry on the work. Communication in the Police Department at present is carried on

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mostly, if not altogether, by telephone, so none of the men in the wireless school has been in active practice of telegraphy for a long period, except some who, like myself, keep up their practice at home. Personally, like many another telegrapher, telegraphy has always been my hobby since boyhood days when my schoolboy friends and I started a home-made telegraph line with six stations, and had the greatest fun of our lives as amateur telegraphers. That was long before the days of wireless, of course. I was smitten with the wireless fever about six and one-half years ago, and studied the art and made it my business to get a license as soon as possible.

"This wireless set has not been installed at Headquarters as a demonstration of the utility of radio telegraphy in departmental work alone. It is the intention of the Commissioner, if the operation is successfully carried out, to have wireless service in each of the five borough headquarters, and then in each of the sixteen inspection districts of the Department. Naturally, there is a broader view as to its application in the near future, when radio apparatus will be a feature of the police service in every police station in New York City."

The wireless telegraphy training school at Police Headquarters is a typical schoolroom, with desks and blackboards. Here one may see the grizzled veteran of the Police Department, the old campaigner who has experienced all the trials and tribulations of the service, and has seen human life in all its phases, as only the policeman sees it, seated beside the recruit new to the service to which the uniform and brass buttons have just attracted him. Each of these first fifteen men has been assigned to attend the classes for radio instruction daily for a period of thirty days up to June 30, and they are promptly at their desks from nine o'clock in the morning until five o'clock in the afternoon.

The instruction given the men is based on the system of wireless instruction of the Marconi Wireless Company of America, "How to Pass the U. S. Government Wireless Examination," being used as a textbook. Two hours of every morning

*Chief Inspector Max F. Schmittberger*

are devoted to instruction in diagrams and technical work and one hour to code practice. In the afternoon, two hours are devoted to each of these branches. The men are spurred on to effort by the fact that the Commissioner wishes them to make good as wireless operators in the short space of thirty days, a record time in which to gain a mastery of the art. But all of them being practical telegraphers, it is the hope and ambition of this first class in wireless telegraphy organized by any police department in the world, to make a record showing. The regulation wireless instruction is being extended to the pupils of the headquarters school that will enable them to pass the Government examination and get a Federal license. Long before this class has passed the first stage of its studies, Commissioner Woods hopes to have others organized from the members of the Police Department, for it is his aim to get as many men as he can, as soon as he can, to make the Department familiar with wireless telegraphy and efficient in its operation.

"Until we get all of our stations in the Department in operation," said Sergeant Pearce, "it is the intention of the Commissioner to have us try to locate the

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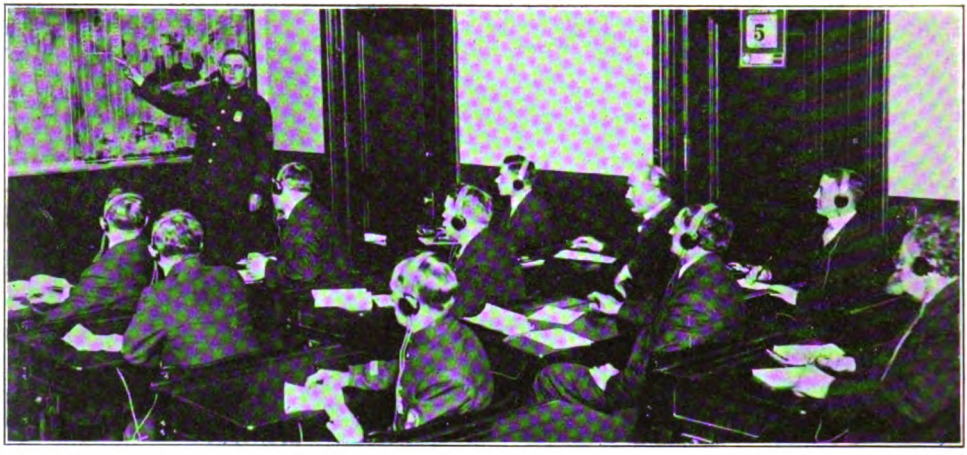

*Sergeant Pearce giving instruction to the wireless class at headquarters. Those who have had experience in telegraphy have been selected to attend this school of instruction*

better grade of amateur stations that are situated near the station houses, which can handle the business that will be given to us from Police Headquarters. It is to be taken for granted, however, that the work of such amateurs will prove a valuable auxiliary to the Department permanently in picking up messages that will be of service in the line of police duty and also in emergency work in times of great disturbance and public necessity.

"The adaptation of wireless to departmental work is, of course, an amplification of the preparedness plan of the Commissioner. He has selected 3,000 men out of 10,000 men of the Department to obtain an efficient course of military training at Fort Wadsworth, Staten Island. A training camp is already in operation there. Of the men selected, 300 are taking a two weeks' course at Fort Wadsworth in regular military tactics. These two weeks are being given to the men in addition to their ordinary vacation. The entire 3,000 will be instructed in this manner, over a course of twenty weeks. The men have a regular encampment, where there are drills during the day, instruction in the manual of arms, rifle shooting, and, in fact, the regular training of a soldier. It is intended that the New York Police Department will in this way be enabled to join with the naval and military forces of the country should the need ever arise.

"We hope to be able to install a wireless station at this encampment at Fort Wadsworth as soon as possible, that the value of the wireless service in police duty may be more strongly emphasized. And this is primarily so, because it is realized that in case of any great public disturbance, such as strikes, riots or rebellion, the telephone system of the Police Department might be interfered with or destroyed, and reliance would have to be placed absolutely on wireless communication for the marshalling of the police forces in the maintenanec of order in the city.

"It is realized also that portable wireless sets will be of immense service to the Department, sets such as the field packs that are used in army service. The New York Police Department maintains order not only in the city, but also in the waterways surrounding the city Wireless installation on harbor craft, such as the steamer Patrol of the Harbor Squad, would be invaluable in the protection of life and property along the river fronts and in the Bay. In addition to that, we are also looking for a set that can be put on the patrol wagons, where the electric current to operate it may be generated from the motors of the automobile wagons."

Talks with officials of the Police Department as to the wider application of the wireless in its adaptation to police work reveal the great benefits that the service would derive from radio teleg-


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raphy in the ordinary course of police surveillance. One of the most tragic disasters that ever occurred in New York was the destruction by fire of the excursion steamer General Slocum in Long Island Sound some years ago. Had a system of wireless communication been in force at the time of this great disaster, the work of Police Headquarters on land and water would have been expedited in great measure, and the loss of life would undeniably have been averted, or at least greatly minimized.

Another factor in the life of New York, which is one of the greatest ports of the world, is the frequent occurrence of disorder and even mutiny aboard the steamships that are anchored in New York Harbor. The sending of aid to such vessels is often a difficult matter, in that information of such disturbances is delayed. Were there an efficient wireless service in the Department, covering land stations and the craft of the Harbor Police, the maintenance of order on the great waterways about the Metropolis would be on a far more efficient basis.

Nowhere more than in police work is it realized that criminals are apt to take advantage of every step forward in invention and scientific discovery. It is the boast of the efficient burglar that he can break the most modern safe. This, of course, is due to the fact that the streak of criminality runs through all phases of the social body, and the trained and efficient workman is often as apt to become a lawbreaker as his more ignorant fellow worker. Strange as the term may sound, it is nevertheless an established fact that river piracy is a great menace to property interests along the great and extensive waterways of New York. Warehouses alongside of docks are looted and vessels moored to piers are despoiled of valuable portions of their cargoes by thieves of the waterside, who have all the resources of co-operation with corrupt watchmen and mercenary crews, and can bear their booty away in motor launches of the most modern type. The vigilance of the Harbor Police would undeniably be made much more efficient were the wireless service added to their equipment.

Added to this, the dangers attendant upon the frequent occurrence of fire on board vessels in New York Harbor would be lessened greatly, if a wireless service could provide prompt notification to the Harbor Police, who could thus notify and work in conjunction with the New York Fire Department in the lessening of such calamities.

Periodically, great, and it would appear, unavoidable calamities occur in every large community. While some of them originate from social unrest and economic stress, others are due to natural causes, such as earthquakes and floods. Again, vast conflagrations occur. It is of vital consequence to the social body that order be preserved during such periods of trial, and this duty, the maintenance of order, with its concomitants, the protection and preservation of life and property, fall to the lot of the police departments of great cities. That the wireless service is an aid and even more than that, a salvation, goes without saying. Where large bodies of policemen must be hurriedly sent to certain danger points, and in the meantime the ordinary means of communication have been destroyed, the wireless affords a method of communication to which there is no danger of interruption of service. Squads of men can be sent through the medium of radio communication to given points from headquarters far distant from the scenes of disaster, where efficient and watchful officials are kept in touch with the needs of such occasions. Naturally, in such days of calamity, the value of a large force of men, trained in the art of wireless telegraphy is made manifest. But such organizations cannot be created in a day. They are the result of foresighted plans of efficient departmental heads, who realize the value of trained bodies of men in the great and inevitable emergencies to which unexpected occurrences subject modern communities.

As cities grow and countrysides become populated, casualties wax in proportion. It is the duty of civil communities to be prepared for days of disaster. So long as the human equation prevails in life, so long as the millennium does not arrive, strikes and riots are unavoidable occurrences in the economic life of the nation. Order must be maintained. A police department efficiently equipped, can cope with any emergency.

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# From and For those who help themselves

## Experimenters' Experiences.

*The editor of this department will give preferential attention to contributions containing full constructional details, in addition to drawings.*

### FIRST PRIZE, TEN DOLLARS
### A Home-Made Aerial Hot Wire Ammeter

An important acquisition to any amateur station is a hot wire ammeter for determining the current flow in the antenna circuit and conditions of resonance between the primary and secondary windings of the oscillation transformer. I constructed an instrument of this type after the designs indicated in Figs. 1, 2, 3 and 4, and it has proved satisfactory in every respect. The majority of materials for this instrument can be found in the junk at the average amateur radio station; this, coupled with the fact that only a few tools such as drills and taps are required to construct the instrument, should appeal to the experimenter whose laboratory equipment is limited. The dimensions and sizes for the various screws and pieces of brass may vary considerably without destroying the efficiency of the meter, with the one exception—that the spring brass referred to should not be thinner than 1-16 of an inch.

The general arrangement of this meter is indicated in Fig. 1. The expanding hot wire is of No. 30 copper and is kept tightly between the lugs A and B, which are mounted on two square, hard-rubber blocks. The brass lugs are constructed to take the wire, thereby holding it in place and allowing the tension to be rather carefully regulated.

Fig. 2 indicates in detail how the brass block is mounted on the hard-rubber base and, as shown, the former is split with a hacksaw ¾ of its length to take the expanding wire.

The pointer for the instrument and the balancing arm are shown in detail in Fig. 3 and Fig. 3-a. The latter figure indicates the manner in which the balancing arm should be turned. It is drilled with a 1-16 inch drill on each end with the center part 3 filed flat on the top and bottom. A 1-16 of an inch hole is drilled through the flat side to receive the spindle and, as will be observed, the filing of this part to a flat shape will leave two small tips on each side.

To continue the construction: Take two common pins and cut off the tips about ¼ of an inch from the head. Lay them in between these lips and pinch them tight with a pair of pliers, leaving the heads on one side pointing down and on the other side pointing up. It is to this arrangement that the silk thread is tied.

The aluminum pointer is constructed by shearing a thin strip from a sheet. If a sheet of this material cannot be obtained, substitute a piece of copper wire; however, aluminum is to be preferred. The details for the construction of the spindle are given in Fig. 4. This can be made from a 1-16-inch drill shank, as it is short and will not completely ruin the drill. This shank may be pointed at both ends by placing it in the chuck of a lathe and tapering it to a fine point by means of a sharp file. It should then be polished with a fine oil stone. Particular care must be



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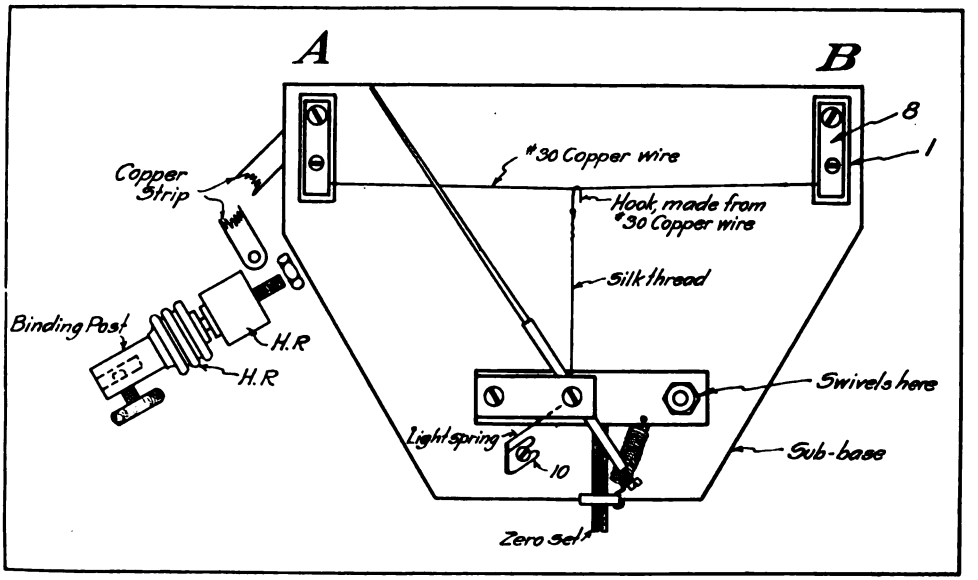


*Fig. 1, First Prize Article*

ken in the formation of this point to make it perfectly smooth and true. After completion the ends of these points are placed in the small lugs indicated in Fig. 4. The latter can be made from 8-32 machine screws drilled on the end to form a cup.

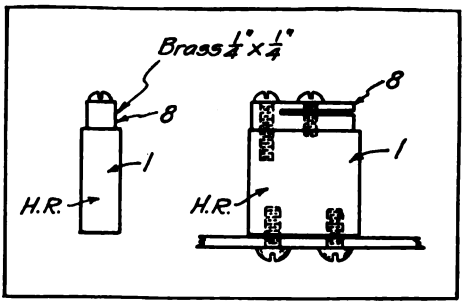


*Fig. 2, First Prize Article*

A very light phosphor bronze spring is indicated in the detail 10, Fig. 4. To this is attached the silk thread which is wound around the spindle, Fig. 4, and is fastened to the pin heads. The function of this spring is to keep a tension on the pointer, thus tending to wind up the thread which is wound around the other end of the

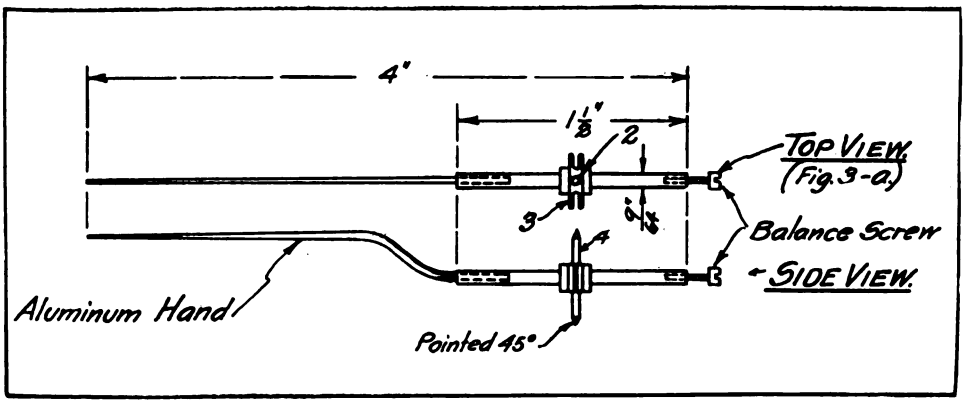


*Fig. 3, First Prize Article*

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spindle fastened to a small hook attached to the expanding wire.

The balancing arm should be perfectly balanced in the holder before the silk threads are fastened.

The entire instrument is then fastened on a sub-base as indicated in Fig. 1, after which it is to be mounted in a wood or metal box. This instrument can be satisfactorily calibrated by connecting it in series with another ammeter and supplying them with definite values of current.

If No. 30 wire is used for the expanding element the instrument will have a range of about five amperes which is quite satisfactory for a 1 k.w. transmitting set. By the use of No. 32

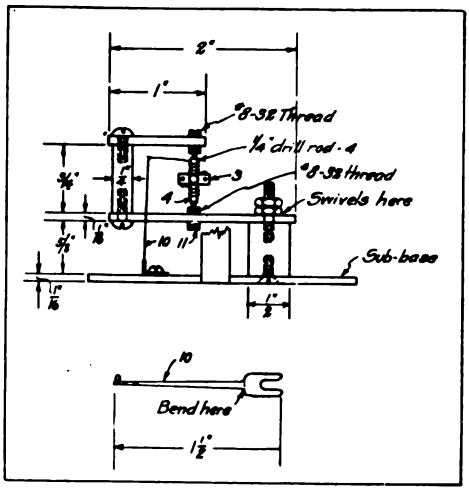


*Fig. 4, First Prize Article*

copper wire the instrument will give a full scale reading of approximately three amperes. Similarly, No. 36 copper wire will give a full scale reading of about one ampere, which is quite suitable for the average spark coil set.

The complete operation of this instrument can be readily understood from the drawings, current flowing through the expanding wire from post A to B causes this to heat and expand. This, of course, decreases the tension on the silk thread, which in turn releases the tension on the shaft and through the medium of the phosphor bronze spring the pointer is moved from the zero towards the full scale position.

G. R. SIMMONS, *Louisiana.*

## SECOND PRIZE, FIVE DOLLARS

### A Practical Dead End Eliminating Switch

In my opinion the attention of the average electrical experimenter is more apt to be held by the description of a wireless instrument requiring for its construction a simple set of tools and supplies rather than one necessitating the use of a machine lathe or an elaborate workshop equipment. Hence I will describe the design of an important part of the receiving tuner which may be constructed by any amateur possessing a couple of small drills, an old pair of scissors, a file and a soldering iron.

The device I am about to describe is known as a dead end eliminating switch, the important feature of the design being that this switch operates in conjunction with the inductance—changing switch, cutting the several units of inductance into the circuit as they are required. The switch may be effectively employed in either the primary or secondary windings of the receiving tuner, and by use of it increased strength of signals is obtained when used with a tuner designed to cover a considerable range of wavelengths.

The principal parts of the switch can be purchased ready for use and it is simply a matter of drilling a few holes to continue the assembly. Referring to the detail drawing: detail P is a hard rubber sheet ¼ of an inch or 5-16 of an inch in thickness. Drill a hole in it 5-16 of an inch in diameter to a depth of ⅛ of an inch, and then continue right through the rubber with a 5-32 drill. The 5-16 of an inch hole, ⅛ of an inch in depth, is intended to take the end of the nut which projects through the washer so that it will lie flush with the surface of the hard rubber.

Detail D is a brass washer ⅞ of an inch in diameter, with a 5-16 of an inch hole. This is a stock size and can be purchased at any store selling material of this kind.

Detail G is a battery nut from a Columbia dry cell. With a little pressure it can be forced into the 5-16 of an

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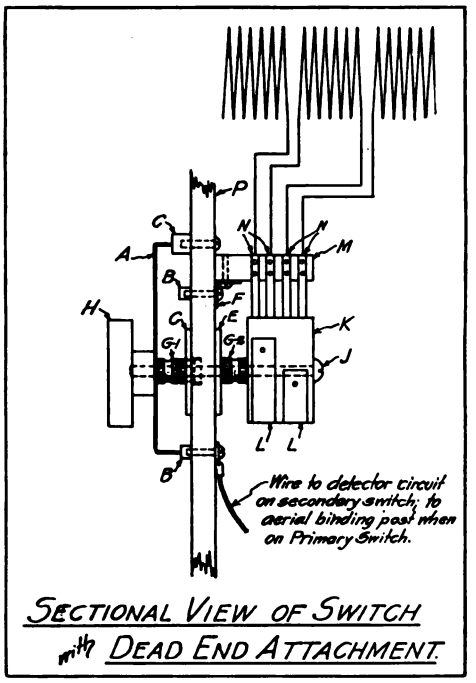


*Fig. 1, Second Prize Article*

inch hole in the washer D, the rough end of the nut preventing it from falling through. Next lay the two pieces on a flat surface centering the nut in the washer, after which they are soldered together. Follow this by running a 5-32 inch drill through the nut to clean off the thread. The bearing for the entire switch is now complete.

Detail C is the usual ¼ inch in length by ¼ inch in diameter switch stud. Detail A is a phosphor bronze strip ½ inch in width with a 5-32 inch hole drilled as per the drawing. It is bent over at the dotted line.

Detail B is 3-16 of an inch in width and is cut from an old piece of brass pipe 2 inches outside diameter. The edges are finished smooth with a file. If a piece of pipe is not available, an ordinary solid brass curtain ring can be used if it is filed a little flat on both sides. This portion of the switch is the most important; the usual design, where the wire is soldered to the screw I or to a washer underneath it, is not recommended. The ring insures a perfect self-cleaning contact at all times.

Detail E is a piece of flat brass or a washer with a 5-32 hole. The actual shape of it is not important, but the surface must be true.

Detail G is a nut from a Columbia dry cell having a perfectly true surface.

Detail J is an 8-32 machine screw, 2¼ inches in length.

Detail H is a hard rubber handle.

The dead end switch can be constructed according to the following explanation: Detail K is a piece of fibre rod 1¼ inches in diameter and ¾ of an inch in length, to which are attached two copper strips, L, ¼ of an inch in width. Copper is recommended for this part, as it is soft and will retain its shape when bent around the fibre rod, K. The copper strips, L, are fastened to the fibre rod with small machine screws. It is well to drill a hole slightly smaller than the screws through the copper and into the fibre rod. The screw will then cut its own thread. After this, cut the head off the screw and file it down smooth and level with the copper strip.

Detail M is a piece of fibre ⅜ of an inch in thickness, ½ of an inch in width, and 1⅛ inches in length, to which are fastened the four strips, N, of phosphor bronze. The latter are ⅛ of an inch in width and 1 inch in length. Small wood or machine screws can be used to hold them in place. The

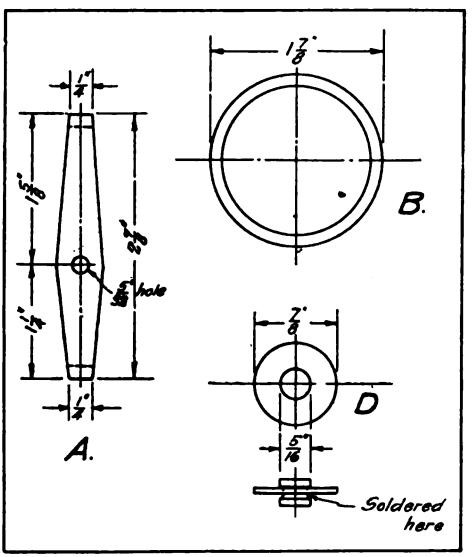


*Fig. 2, Second Prize Article*

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strips should be cut a little long if necessary so that when the switch is assembled a slight turn on the end of each will enable it to slide over the copper strips, L, smoothly.

A small piece of ⅜-inch angle brass to support the fibre, M, is indicated in detail F. Fibre is preferred at this point instead of rubber because it holds the screws better.

The actual length of the copper strips, L, depends on how the dead-end taps are to be taken from the coil. If a complete circle of switch points is decided on and the coil is divided into three equal parts, the length of one copper strip, L, will equal in length ⅔ of the circumference of the rod, K; the other strip, of course, will equal ⅓ of the circumference. The longer strip will close up the first break in the inductance coil and the shorter strip the second break. It will continue to do so until the last switch point is reached.

It should be mentioned during the assembly of the switch that the nut, G-2, must be screwed as tightly as possible against the fibre rod, K, the latter having a 5-32 inch hole drilled exactly in the center.

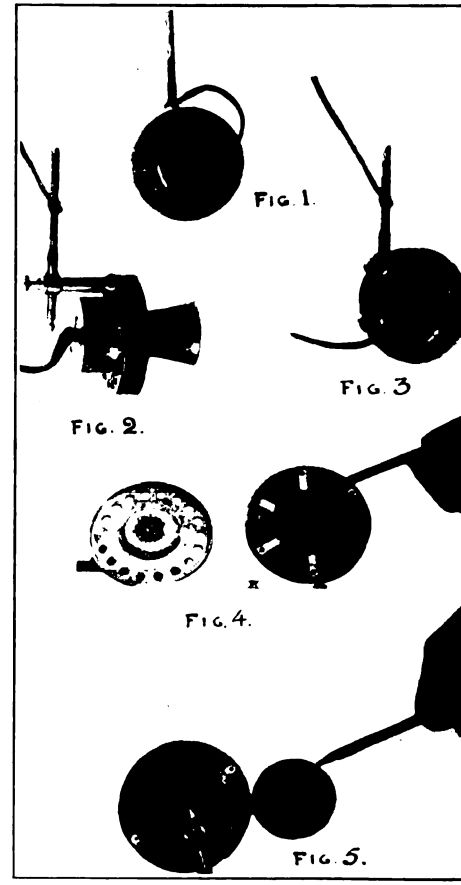
I believe that the complete assembly of the switch will be clear from the drawing and if the builder will take the pains to nickel plate the various metal portions he will possess a dead end switch of unusually neat appearance and one which will not be apt to give trouble from day to day.

JOSEPH FURLONG, *Massachusetts.*

## THIRD PRIZE, THREE DOLLARS

### A Heavy Current Transmitter for the Radio Telephone Experimenter

In the columns of magazines devoted to the American electrical experimenter, one often sees a query concerning the construction of a reliable transmitter that can be used for radio telephone work. As is well known, the ordinary microphone transmitter is not well suited for this purpose because the amount of energy that it can handle is rather limited, and in view of the fact that considerable energy must flow through the transmitter when employed in wireless telephone work, it is necessary to construct a microphone of unusual current carrying capacity. In the design here presented no dimensions are given, for a change in the size of the various parts does not materially affect the workings of the complete transmitter; hence it is expected that the experimenter who duplicates our




*Illustration, Third Prize Article*

design will make use of those materials he may have at hand.

A front view of the transmitter is indicated in the accompanying photograph, particularly Fig. 1. In order to give the experimenter some idea of the size of the microphone we have constructed it may be stated that it is 4 inches in diameter. A side elevation of the device may be seen in Fig. 2; this photograph brings out clearly the construction of the chamber holding

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the insulated slate cup, which in turn contains a teaspoonful of carbon grains. The latter may be purchased from any large electrical company handling telephone supplies, but care should be taken to select the types that are larger than the grains used in the ordinary telephone transmitter, as the larger ones do not burn up as quickly as the smaller. At the extreme rear of the chamber is shown the fibre insulation used to conduct the electrodes into the cup containing the carbon grains.

In the photograph, Fig. 3, the details of the round fibre piece are shown. The two set screws at the circumference are used to prevent the electrodes, shown in the center of the fibre plate, from moving in and out after once being adjusted. In actual use, one wire of the aerial circuit at a given radio station connects to these electrodes, the other wire of the aerial circuit being fastened to the metal standard which is used to support the transmitter in any desired position. This is effected by means of the set screw shown on the metal projection. The front half of the transmitter is fastened to the back half by two set screws shown near the circumference of the piece 4 inches in diameter, and the holes indicated are drilled out to permit air to circulate and to keep the inner chamber cool.

The right hand character in Fig. 4 shows an inner view of the front half of the transmitter. A circular piece of thin mica is used to hold the carbon diaphragm in place. The six springs shown also keep the tension of the carbon diaphragm constant. The long threaded screws are those mentioned as holding the front and back halves of the transmitter together. The left hand character in Fig. 4 shows the inner chamber holding the carbon grains. The photograph also indicates clearly the main chamber of slate while a ring of soft asbestos may be seen. The purpose of the latter is to keep the carbon grains from packing under the slate cup and the carbon diaphragm. In the center of this cup is a thick piece of mica which is not generally necessary, but was used by us in certain experiments requiring the use of two sections of carbon grains in the cup.

The rear inner construction of the slate chamber is indicated in Fig. 5, also the electrodes that conduct the current into the cup holding the grains. To the ends of the electrodes are attached pieces of ordinary hard carbon.

A novel feature of this transmitter is that the chamber holding the grains may be made to hold more carbon by simply loosening the set screws holding the electrodes in place and drawing them outward. This feature also assists in making the initial adjustments during the preliminary tests.

The mouthpiece of the transmitter is similar to that found on all instruments of this type. It may please your readers to know that a transmitter of this type has actually been used in a circuit carrying a considerable current, and so far it has functioned perfectly in constant service.

EARLE HANSON AND ALBERT MARPLE,
*California.*

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## FOURTH PRIZE, SUBSCRIPTION TO THE WIRELESS AGE

### A Universal Crystal Holder Which Will Appeal to the Amateur

All minerals used in receiving detectors with which the writer is familiar have certain parts which are more sensitive than others. So a detector-holder enabling one to quickly and easily search the surface of the mineral for the most sensitive point, and which, when found, maintains its position upon it with any desired pressure, constitutes the maximum of desirable qualities. The accompanying drawing gives the constructional details of a detector containing all these points, and, moreover, its simplicity of construction is at once apparent.

In the accompanying drawing, Y is a brass strip 1-16 inch thick, 3/8 inches in width, and 1 3/8 inches in length. One end is bored to fit loosely over the 8-32 bolt in the binding post, X, while to the other end a mineral-cup is either bolted or soldered, preferably the latter. The binding-post, X, has an additional lock-nut, K, permitting the part Y to swing to the right or left.

Part B is a 3-16 inch brass rod two inches in length with one end tapped

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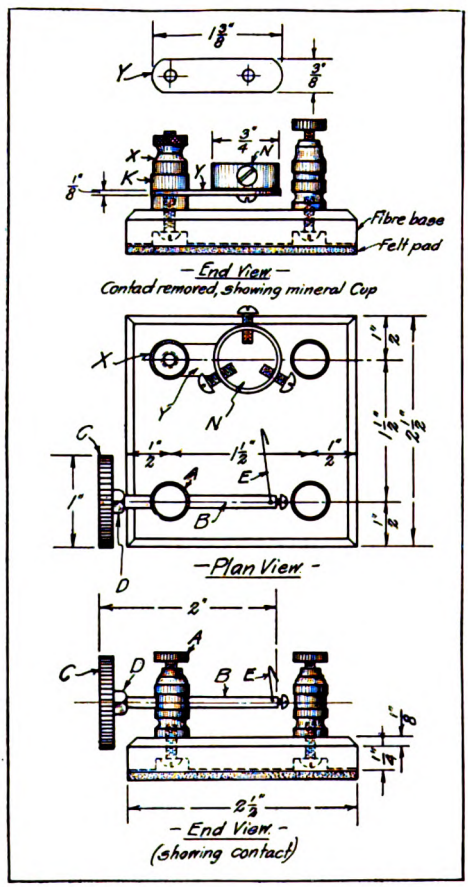
to receive a lock nut and a composition or fibre knob, C. The other end of B receives the phosphor bronze wire, which is of No. 26 or No. 30 gauge by either soldering it or by tapping the rod and inserting a small clamping screw, as shown in the detail 1. The binding post, A, is tapped so that the rod, B, will have a snug fit.

As will be apparent, any spot on the surface of the mineral can be easily




*Drawing, Fourth Prize Article*

reached by the contact point, either by swinging the mineral cup to the right or to the left, or by pushing in or pulling out the rod, B, while pressure is obtained by revolving the knob, C. Should there be any discrepancy in the fit of the rod, B, in the hole in the binding post, A, a clamping screw may be utilized to maintain it in any position desired.

CHARLES E. BEALOCK, *California.*

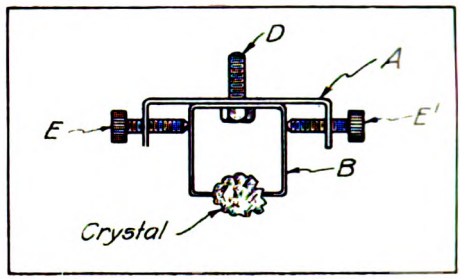



*Fig. 1, Honorary Mention Article, H. Dwight*

## HONORARY MENTION

### A Novel Detector Cup of Considerable Merit

Being unable to purchase a detector cup of the usual design in the local supply shops, I constructed a crystal holder which I believe to be more convenient than those ordinarily supplied. The holder consists essentially of a piece of strip brass ⅜ of an inch in width 1¼ inches in length, and about 1-32 of an inch in thickness, bent at right angles ¼ of an inch from each end, after which it is drilled and tapped to take the bolt and the thumb screws, E and E', as indicated in Fig. 1. B is a piece of hard drawn copper ribbon, or preferably a piece of phosphor bronze, ⅜ of an inch in width and 1½ inches in length.

As shown in Fig. 2, this strip should be cut down to ⅛ of an inch in width at each end and drilled for the bolt D. It should then be bent to take the shape as in Fig. 1. A and B are bolted together with a small machine screw or bolt D and the thumb screws, E, E', inserted in the tapped holes. The spring should be bent with the jaws well open, so that there will be the correct degree of tension on the thumb

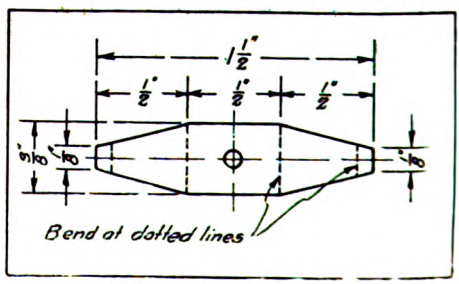



*Fig. 2, Honorary Mention Article, H. Dwight*

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screws to grip the crystal firmly. It is found extremely easy to insert small pieces of crystal into this holder which, as is well known, is not the case with certain types of detector cups.

H. W. DWIGHT, *Massachusetts.*

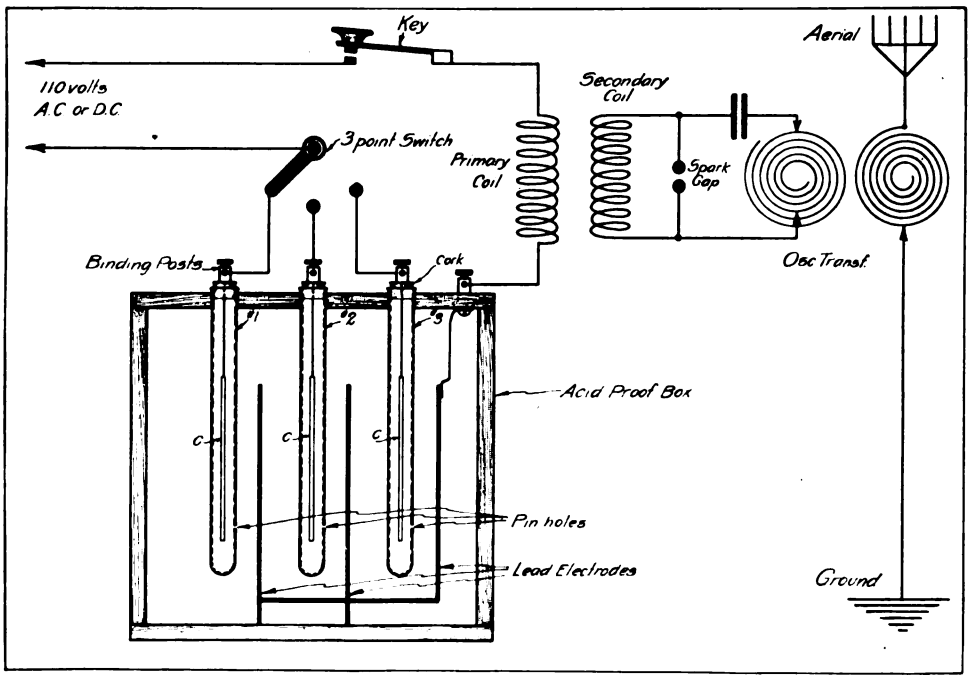
## HONORARY MENTION

### A Multi-Tone Interruptor for a Spark Coil

The accompanying drawings cover the construction of a three-tone interruptor which I have used continuously for five months at my station, and so far I have experienced no trouble whatsoever. In addition, I find that it gives a spark note equal to any rotary gap which, as is well known, cannot be used with an induction coil.

The important parts of this interruptor are the test tubes 1, 2 and 3, which are about 12 inches in length, 1 inch in diameter. The most difficult part of the construction work is the puncturing of a small hole in the ends of the tubes. About 1 inch from the closed end of the test tube file away the glass with a small sharp three cornered file and turpentine. If this work is done very carefully the glass may be filed so thin that the point of a small pin can be passed through the tube.

To continue the construction an acid-proof box is required which may be made from heavy oak boards boiled in paraffine wax. In the cover bore three holes just large enough to take the test tubes. In each tube is suspended a copper electrode, C, which is connected to the external circuit by means of a binding post mounted in a cork over the mouth of the tube. At the bottom of the tank are placed three sheets of lead connected together and finally




*Drawing, Honorary Mention Article, George Levine*

connected to the extreme right hand binding post. These sheets may be about 1½ inches in width, from 8 to 10 inches in length, and about ¼ of an inch in thickness. The interruptor box is then filled with three parts of water to one of sulphuric acid.

As will be observed from the drawing, any one of the interruptors may be connected in series with the primary winding of the induction coil by means of the three point switch and if care is taken to make a hole of different diameter in each tube three distinct tones will result which are highly pleasing

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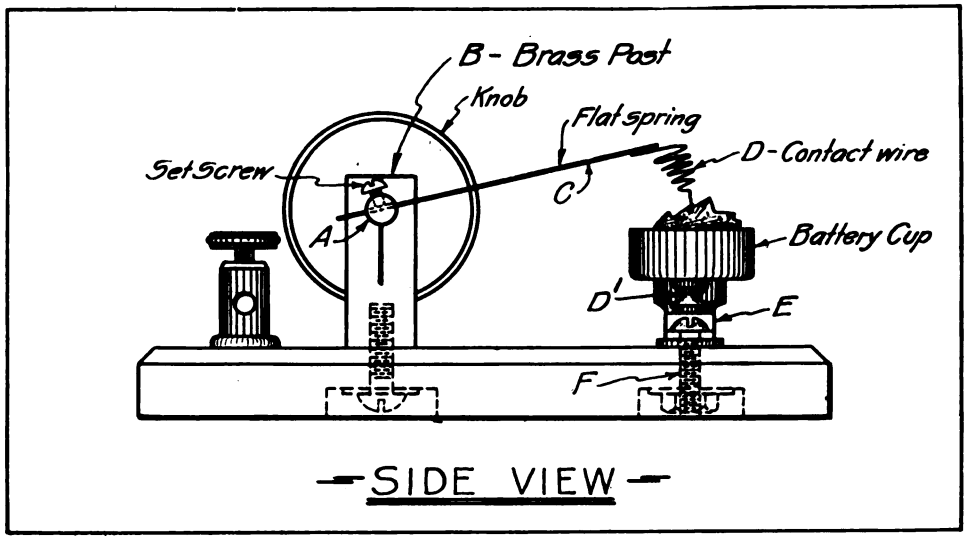


*Fig. 1, Honorary Mention Article, William A. Barnes*

to the ear. For a low tone one of the holes should have a diameter of about 4 pin points; for a medium tone about twice the size of an ordinary pin point, and for a high tone the diameter of a single pin point suffices. I have found by experiment that the dimensions given do not hold for all sizes of spark coils and will have to be varied with each different design. Different percentages of the acid solution will also often increase the pitch of the note. If care is taken in punching the holes in the test tubes and the right ingredients are used in the solution, the experimenter can afford considerable amusement to his fellow amateurs by sending out signals of different tones. It is possible by more elaborate construction to construct six or eight interruptors of different tones in this manner and thereby imitate the octave of an entire scale.

GEORGE LEVINE, *Iowa.*

## HONORARY MENTION

### A Crystal Holder Applicable to All Types of Minerals

A convenient design for a crystal detector holder is presented in Figs. 1 and 2. One of this type has been found extremely useful at my station, since it is applicable to crystals of all types and kinds. The construction and adjustment to sensibility will be apparent from the following description:

A side view of this detector is indicated in Fig. 1, and an end view in Fig. 2. The post, B, is of brass which is slit through the center with a hacksaw and drilled to take the ¼-inch brass rod, A. The latter rod should fit the hole snugly, the tension being afforded by pressing the ends of the upright post, B, together with a large pair of pliers after the slit has been made. The adjusting rod, A, is fitted with a large hard rubber knob and is slit at its opposite end and fitted with a set screw to take the flat spring, C, on the end of which is mounted the contact wire, D.

The arm, E, is made of heavy brass strip drilled to take the bolt, F. On the oppposite end it has mounted the hard rubber knob, G, and the crystal cup which is fastened in place by means of the knurled battery post nut, D, which is also soldered on E. The crystal cup is taken from round battery carbon and being inexpensive, each mineral may be mounted in a separate cup which may be screwed into the nut, D, and quickly removed for a change. The spring, C, being interchangeable, any type of contact with different degrees of elasticity may be employed.

It will now be apparent from the drawings that the crystal mounted in the cup on the lever, E, may be moved

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back and forth by the knob, G, allowing the contact, D, to be placed on various portions of the element. The tension on the contact, D, is regulated by the large hard rubber knob but different points on the crystal are obtained by moving the cup about. Because of the ease with which a sensitive spot on the crystal can be located, a detector of this type is particularly recommended for experimental purposes and for testing out the sensibility of various minerals.

WILLIAM A. BARNES, *Connecticut.*

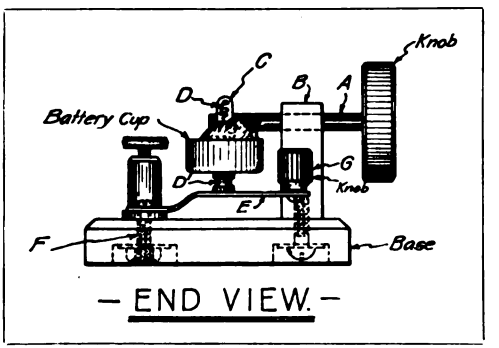


*Fig. 2, Honorary Mention Article, William A. Barnes*

## HONORARY MENTION

### The Removal of Inductive Effects Caused by Power Lines

I notice from various publications that a great many amateurs have trouble from alternating current inductive effects on their receiving sets. Having been a chief engineer of different hydro and steam plants over the West for the past ten years, and having experimented with wireless apparatus for the past two years, a few notes on my experience may be of interest to your readers. At present I have a station where the instruments are located but thirty feet from a large alternator and forty feet from the switchboard and fifty feet from a high tension line.

I hear many medium and high-power stations in the United States and Canada, including Alaska. Quite often I hear the Mare Island Navy Yard at San Francisco and Arlington on 2,500 meters at the same time.

For a period I experienced considerable trouble from induction when using a vacuum valve detector, but found it to be due to a battery and buzzer connected to a ground wire in the building. At another period my vacuum valve seemed to emit severe inductive noises, but later I found it was due to the fact that the high voltage battery was reversed in polarity. At one time I experienced an unusual amount of induction from a power house, and discovered later that my ground connection was making a very poor contact. I take the precaution now to keep all drop cords and lamps from two to four feet from my receiving set, for occasionally I find that the inductive influences are led to the receiving apparatus through them. During the reception of signals, I also keep my hands clear from all metallic parts of the instrument. I have insulated the lead-in and ground wires thoroughly. So far in my experience the only inductive noise I have not been able to eliminate entirely is that produced by the contractors on the Tirrell regulator. Our exciter commutators and collector rings at this power plant are kept in good shape, but as soon as they are allowed to get out of this condition, considerable inductive effects are experienced from them.

We have frequently experienced disastrous inductive noises in our receiving apparatus when the high tension line and the telephone line on the same poles become grounded. In a case of this kind it simply puts the wireless telegraph receiving apparatus out of business, and I believe that it is a trouble of this sort that many amateur experimenters experience, but they do not know where it comes from. If every amateur experimenter would take the precautions that I have and would keep all unnecessary batteries, power lines, etc., away from his apparatus, and if he finds by these expedients that the trouble cannot be eliminated it is up to him to tell the man in charge of the power house to clear the ground from his machine or at least clean the commutator.

A. C. CAMPBELL, *Montana.*

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# Wreath for Wireless Operators

The Marconi Wireless Telegraph Company inaugurated a fitting custom on Memorial Day by placing a wreath on the monument in Battery Park, New York, to the operators who have given their lives in the service of the key. Year by year the sea has taken its toll of the lives of the wireless men and as yet no one has failed in the time of crisis to pay the last full measure of devotion. In honoring such fidelity and sacrifice, the company honors itself.

About ten o'clock in the morning a committee consisting of R F. Miller and M. H. Paine, both formerly operators in the Marconi service, placed on the shaft the wreath given by Edward J. Nally, vice-president and general manager of the Marconi Wireless Telegraph Company of America, in the name of the company. It is expected that the custom will be continued hereafter annually on Memorial Day.

The monument itself was dedicated on May 12, 1915, with impressive ceremonies in which Commodore Fred B. Dalzell of the Maritime Association and Acting Mayor McAneny participated, assisted by clergymen and enlisted men of the United States Navy. Upon the column behind the fountain are inscribed the names of the operators for whom it was erected, with a space for those whose deeds will call for commemoration in the years to come.

*Wreath placed on monument to wireless heroes*

It has been announced that the wireless station at Great Lakes, Ill., has been completed and weather reports, time signals and storm warnings will be sent from that point. Aside from the help this first lake station will be to marine men, it will also be of interest to the amateur operators.

Heretofore the storm warnings have been given to vessels upon their arrival at ports. Now those equipped with wireless will know what sort of weather to expect as soon as Washington learns it.

## WIRELESS TORPEDO EXPLODES

R. S. McGuire of Grand Forks, N. D., and two engineers of the United States Government were thrown into the Mississippi River at St. Cloud, Minn., recently when the boat in which they were testing a wireless torpedo steering device invented by McGuire was capsized by the explosion of the war engine. The latter was loaded with seventy-five pounds of gun cotton. The wireless instruments sank, but the three men reached shore safely. By means of his wireless apparatus McGuire had steered the torpedo against a pile of logs in the river. The force of the explosion hurled a large piece of wreckage against the boat, capsizing it.

## LONG DISTANCE RECEIVING AT SEA

The American steamer Ventura, from San Francisco, reports that it picked up wireless messages from the station at Tuckerton, N. J., when 9000 miles from the American plant. This is declared to have broken all records.

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# Some Problems in Antenna Construction

**Part II (Conclusion)**

## Antenna Supports

**By A. S. Blatterman, B.Sc.**

*Wood Pole With Horizontal Load Near Top*—We will consider a supporting structure consisting of a single round wood pole with foundation in the earth and the load applied near the top, as in Fig. 4. The load, P, is the combined load due to the pull of the wires plus the wind pressure on the pole. The pull of the wires is calculated by the methods given in the first part of this paper. The wind pressure is in reality distributed along the whole length of the pole, but it is more convenient to consider it as a single equivalent load applied at the top. In estimating this equivalent load one-half the total wind load can be considered as applied at the top. This gives the same results as the application of the total pressure at the middle of the pole. It is well to remember, however, that the wind velocity is comparatively small at ground level and increases with the height.

We must first compute the required diameter for a given value of P. This is determined from the formula:

$$d = \sqrt{\frac{P}{0.662 \times T \times t}} \quad \ldots\ldots (12)$$

where d = diam. in inches where load is applied.
P = pull in pounds.
T = allowable tension in the wood in pounds per square inch and is given in the following table.
t = natural taper of pole. (See following table.)

The weakest point in the pole, or the place where the pole will break if failure occurs is at the section, A, distant x from where the load is applied.

$$x = \frac{d}{2t} \quad \ldots\ldots (13)$$

The diameter of the pole at this point $\left(\frac{d}{w}\right)$ is:

$$\frac{d}{w} = 1.5\,d \quad \ldots\ldots (14)$$

**Constants for Poles**

| Kind of wood. | Natural taper, t | T | E |
|---|---|---|---|
| White cedar.. | 0.0165 | 670 | 700,000 |
| Spruce ..... | 0.016 | 720 | 1,200,000 |
| Chestnut .... | 0.016 | 1,200 | 900,000 |

The deflection of the pole or the amount of which the pole is bent from the vertical at the point where the load is applied is:

$$u = \frac{6.78\,P\,h^3}{E\,D^4} \text{ in.} \quad \ldots\ldots (15)$$

when the pole is a round pole of uniform section. When the pole is tapered,

where D = diam. of pole.
$d_g$ = diam. at ground surface.
d = diam. where load is applied.
E = modulus of elasticity. (See table.)

Rigid Steel Tower.—When the supporting structure is a four-legged steel tower of the type shown in Fig. 5, with load applied at the top, the deflection can be shown to be approximately:

$$u = \frac{Ph^3}{Ab^2E}\left(1 - \frac{\pi}{b}\sqrt{\frac{I}{A}}\right) \quad \ldots (17)$$

b = spread at the base in inches.
E = modulus of elasticity.



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= 29,000,000 for structural steel.
A = cross-sectional area of one of the corner legs.
I = moment of inertia of section of one of these legs. (Found from handbooks published by steel companies.)

As an example let us calculate the deflection from the vertical of a steel tower of the above type, whose corner legs are 4 inch by 4 inch by ¼ inch angle iron, h = 65 ft., P = 12,000 lbs., b = 16 ft.

We have:
P = 12,000 pounds
b = 16 x 12 = 192 inches
h = 65 x 12 = 780 inches
A = 1.94 (from Carnegie handbook)
I = 3.0 (from Carnegie handbook)
Therefore:

$$u = \frac{12{,}000 \times 780^3}{29{,}000{,}000 \times 1.94 \times 192^2} \times \left( I - \frac{\pi}{192\sqrt{\frac{3.0}{1.94}}} \right) = 2.2 \text{ inches.}$$

*Guyed Masts*—It is often more economical to erect a thin pole and brace it with guy wires than to attempt to use a single heavy pole as discussed in this article. In fact this is a very usual construction.

It is important in this case to properly locate the guys on the mast and determine the size of the guy wires since these carry practically the entire load. The size of the pole itself is also of importance. The strength of a given structure, including the size of the pole and the size and dispensation of the guys can be accurately calculated. It is, however, beyond the scope of this paper to cover this matter in detail and we shall confine ourselves here to the determination of the size of the main guys on a mast. These are calculated as follows:

It is a safe plan to figure a single guy directly behind the load as able to sustain the total load. See Fig. 6. The tension in pounds in the guy wire is then:

$$\text{Tension} = \frac{P}{\text{Sin } \Theta} = \frac{P \times OC}{CD} \quad \ldots\ldots (18)$$

The pull, P, is taken as the pull of the antenna wires plus half the total wind pressure on the pole. The wind pressure, P, in pounds per square foot on a flat surface normal to the direction of the wind for any given velocity, V, in miles per hour is given by the formula:

$$P = 0.004\ V^2 \quad \ldots\ldots\ldots\ldots (19)$$

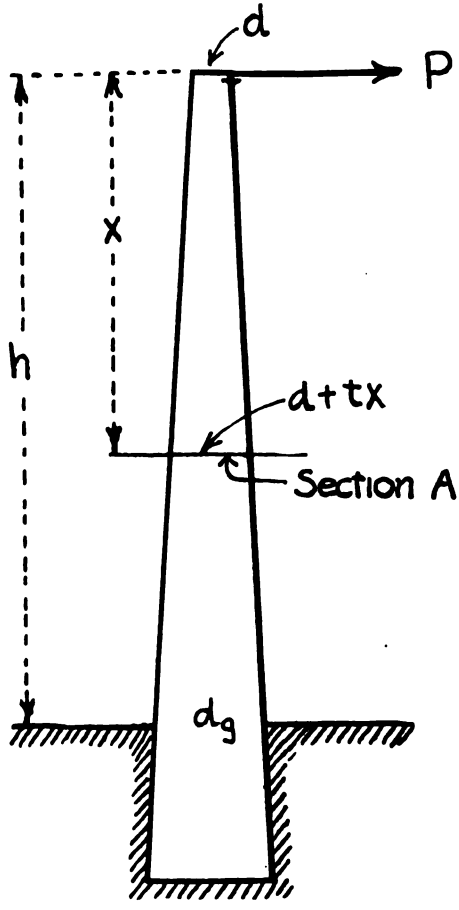


FIG. 4.

When the pole is round the formula is:

$$P = 0.0024\ V^2 \quad \ldots\ldots\ldots\ldots (20)$$

If it is necessary to place a second system of guys below the main guys, as in Fig. 7, a rough indication of the size of wire required can be had by assuming a guy placed in the center of the mast (Fig. 7) to sustain the total normal wind pressure, P', on the pole. On this assumption the tension in the wire is:

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$$\text{Tension} = \frac{P' \times BC}{CD} \quad \ldots\ldots\ldots\ldots \quad (21)$$

Thus a 60 foot round pole 3 inches in diameter, guyed as in Fig. 7 against an 80-mile wind, BD = 30 feet, CD = 40 feet, BC = 50 feet, would require the lower guys to withstand a pull of

$$\frac{P' \times BC}{CD} = \frac{60 \times \frac{1}{4} \times 0.0024 \times 6400 \times 50}{40}$$

$$= 288 \text{ pounds}$$

In designing the wire factor of safety of about 10 should be used.

*Anchors*—It is sometimes the custom to attach the guy wires to anchors sunk in the ground. The anchor may take one of several forms. Concrete may be used, and in figuring the volume of concrete required to resist the lifting force of the guy the weight of concrete may be taken at 140 pounds per cubic foot; or the anchor may be of the type shown in Fig. 8. In this case the anchor tends to lift a cone of earth of height h foot and lower base 2r foot as shown in the figure. For ordinary earth the weight of this cone at 100 pounds per cubic foot is:

$$W = \pi h\, 100\, (r^2 + 0.11h^2 + 0.58\, rh) \quad \ldots\ldots\ldots\ldots \quad (22)$$

*Electrical Considerations*—We have outlined in the foregoing, some of the most important mechanical features of antenna construction. The size of the wire has been determined in respect to its strength, and the mechanical stresses produced in the supports by the pull of one wire is known. Now the number of wires to be used is fixed by the value of antenna capacity required. The capacity also depends on the spacing of the wires and upon their diameter. Apart from the effect of the size of the wires on their electrical capacity with respect to earth, the size of the wire is directly connected with a loss of power from the antenna due to the formation of corona or brush discharge.

When a wire is charged to a high potential of the order of a hundred thousand volts there is a leak of energy into the surrounding air, and if the potential exceeds a certain critical value this leak is accompanied by a visible halo-like glow on the surface of the conductors to which the name "corona" has been given. The loss due to this leakage of current from the conductor into the surrounding air is practically negligible for voltages below the "disruptive critical value;" no account need be taken of such leakage when the voltage is below 40,000. At 80,000 volts, however, the loss may be considerable, and a visible corona may even be formed toward the

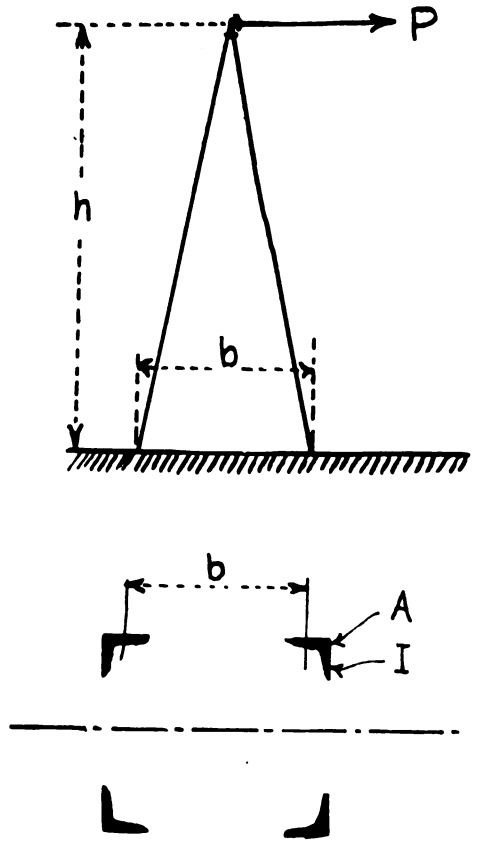


FIG. 5.

upper end of the antenna if the wires are of small diameter.

F. W. Peek* has given a formula for the disruptive critical voltage $V_o$ which for ordinary engineering purposes can be simplified to the following:

$$V_o = 74{,}000\, d \log_{10} \frac{4h}{d} \quad \ldots\ldots \quad (23)$$

where d = diameter of wire in inches.
h = height above ground in inches

This is the potential at which leakage

* F. W. Peek, Proc. A. I. E. E., June, 1912.

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begins and the loss depends on the amount by which the actual voltage of the antenna exceeds this value.

The potential at which corona first becomes visible is always higher than this.

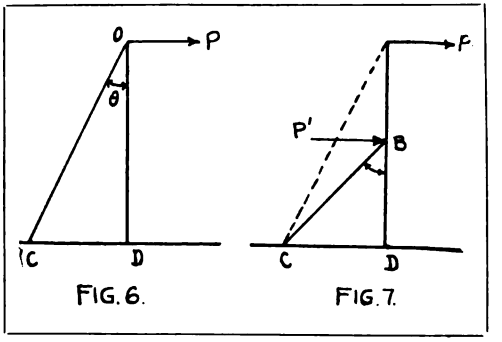


FIG. 6. FIG. 7.

Mr. Peek's formula for the critical visual voltage can be expressed with sufficient accuracy for ordinary purposes as follows:

$$V_1 = 71{,}500\, d\, (1 + \frac{0.267}{\sqrt{d}}) \log_{10} \frac{4h}{d} \quad \ldots (24)$$

The appearance of corona is an indication that there is a loss of power into the air. Mr. Peek has given a formula for the loss of power per unit length of a single wire, all points of which are at the same potential, as in the case of a high-tension transmission line, which is of the form:

$$P = K\,(V' - V'_o) \quad \ldots\ldots\ldots (25)$$

Where V' is the effective value of potential on the wire (to neutral), $V'_o$ is the effective disruptive critical value of potential (to neutral) and K is a constant for any given set of conditions, depending among other things on the frequency, the diameter of the wire and in this case on the height above ground.

Now in a freely resonating wireless antenna there is a standing wave of potential produced with a maximum at the upper free end of the aerial and zero potential at the earthed end. From the free end to the earth the potential gradually decreases approximately according to a sine law, the variation usually being represented by a figure like Fig. 9, the dotted curve showing the distribution of potential with a maximum (V) at the extreme end and zero at earth. Hence, the whole antenna is not at the same potential and therefore the power formula (25) must be modified to properly take into account the variation of the quantity $(V - V_o)$.

The disruptive critical voltage may be represented by the dashed line of Fig. 9. The power loss only extends throughout the length $(l - x)$ where l is the overall length of the antenna and x is the distance from the earth to the point where the potential is $v = V_o$. "x" is calculated from the following formula, which assumes a sinusoidal variation of voltage along the antenna.

$$x = \frac{2l}{\pi} \operatorname{Sin}^{-1} \frac{2V_o}{V} \quad \ldots\ldots (26)$$

$V_o$ being calculated from (23) and V being the maximum value of potential found at the open end of the system.

The writer has developed the following approximate formula for the power loss from an antenna for the case of damped oscillating currents and a sinusoidal distribution of potential based on the formula given by Mr. Peck.

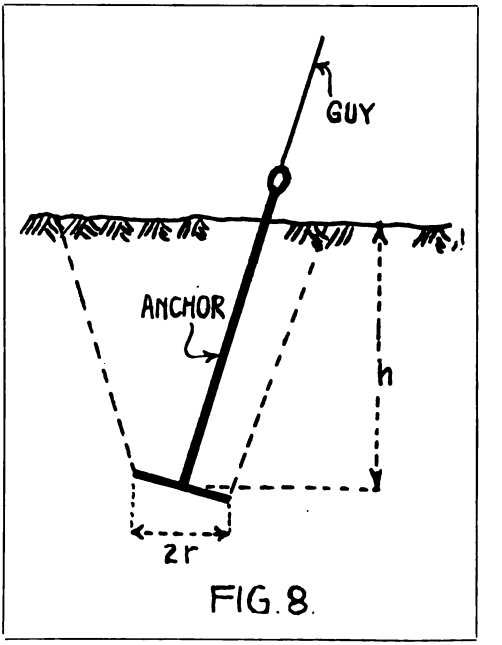


FIG. 8.

$$P = \frac{265}{10^{13}} \frac{N}{\delta} \sqrt{\frac{d}{h}} \left( \frac{V}{2} - V_o \right)^2 \quad \ldots\ldots\ldots\ldots (27)$$

where P = power loss in watts from one wire per ft. length of

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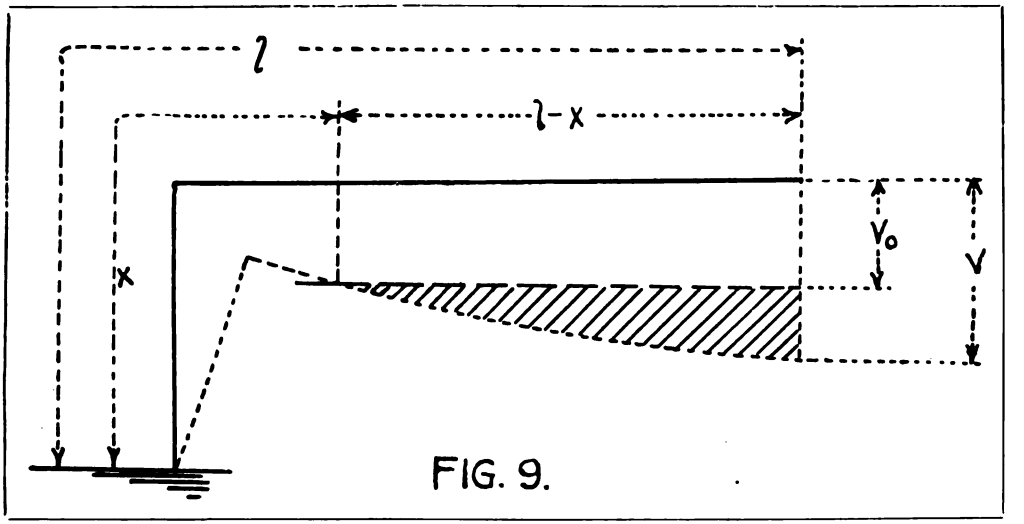


FIG. 9.

the portion whose potential is above the value $V_0$.
N = spark frequency of transmitter.
$\delta$ = decrement per semi-period.
h = height of horizontal part of antenna, in inches.
d = diam. of wire in inches.
V = max. volt. on aerial.
$V_0$ = disruptive critical volt. (formula 23).

The maximum voltage (V) is determined by the effective capacity of the aerial, the current produced therein, the decrement, the wave-length and the spark frequency.

$$V = \frac{26I}{CV}\sqrt{\frac{\lambda\delta}{N}} \text{ approx. } \ldots\ldots\ldots (28)$$

where I = current at base on aerial.
C = capacity of antenna in microfarads.
$\lambda$ = wave-length in meters.
$\delta$ = decrement per half-period.
N = spark frequency.

Suppose we have an antenna 80 feet high and 100 feet long, 4 No. 14 wires, having a capacity of 0.001 microfarads, the current at the base being twelve amperes and let N = 1000, $\delta$ = 0.08, and $\lambda$ = 600 m. Then, by (28)

$$V = \frac{26 \times 12}{.001}\sqrt{\frac{600 \times 0.08}{1000}}$$

= 68,500 volts.

by (23)

$$V_0 = 74{,}000 \times 0.064 \log \frac{4 \times 960}{0.064}$$

= 22,650 volts.

by (27), the power loss per foot of each wire is:

$$P = \frac{265 \times 1000}{10^{13} \times .08}\sqrt{\frac{0.064}{960}} \times (34{,}250 - 22{,}650)^2$$

= 0.364 watts per foot.

by (26) the distance "X" to the point where the potential is $V_0$ is:

$$x = \frac{2l}{\pi} \text{Sin}^{-1} \frac{22{,}650}{34{,}250}$$

$$= \frac{2 \times 180}{\pi} \times \frac{\pi}{4.35} = 83 \text{ feet.}$$

Therefore, the length (l — x) from which loss occurs is:

(180 — 83) = 97 feet.

The loss per foot of one wire is..... 0.364 watts.

The total loss for 4 wires is ..... 4 × 97 × 0.364 = 141 watts.

If the same current were produced in an antenna of the same linear dimensions, damping and wave-length as that referred to, but of one-half the capacity, the loss would be approximately 3 k.w. Now it requires something of the order of 2 or 3 k.w. to produce an aerial current of twelve amperes, so that in this case practically the whole power goes into corona loss in the air.

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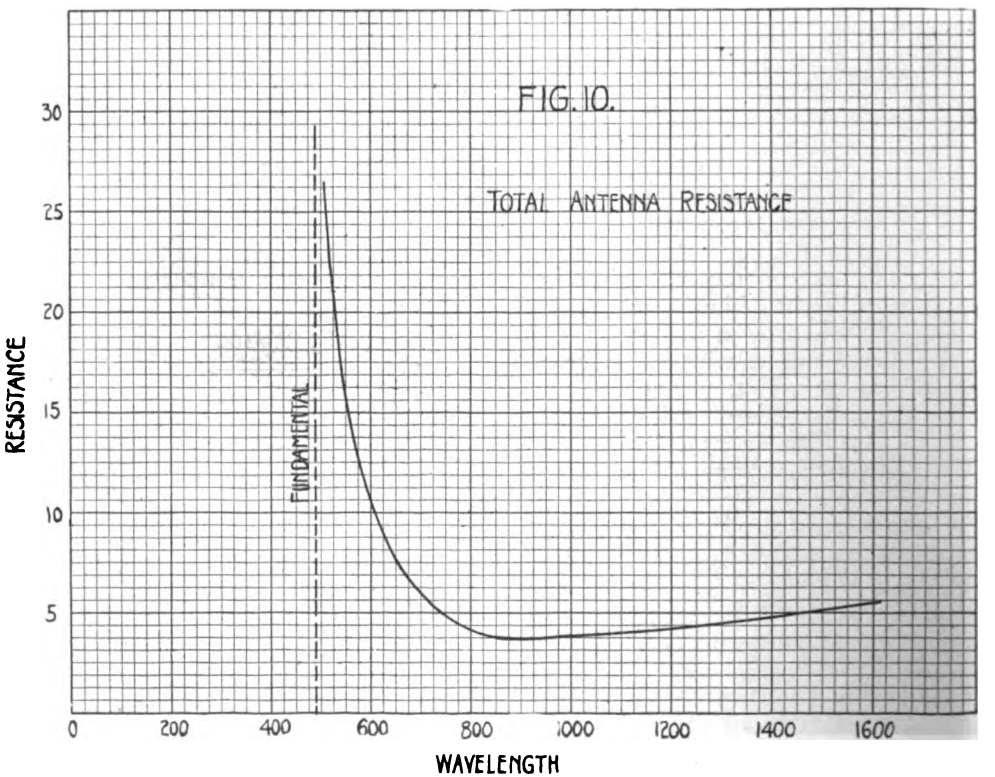
If the diameter of the wires were less, say, 0.05 of an inch, the loss would be approximately 400 watts.

Thus, we see that the capacity of the antenna, which depends particularly upon the number and spacing of the wires for a given wave-length, decrement and spark frequency, as well as the diameter of the wires, is a very important factor. The antenna must be proportioned so that the potentials produced on it under a given set of conditions do not give rise to excessive loss of power through corona.




Still other questions arise relating to the electrical characteristics of the antenna. Among these are the directive properties of the antenna and its effective resistance. The effective resistance is made up of three parts: the resistance of the ground connection, the resistance of the antenna conductors and the radiation resistance due to the production of radiant energy. Both the antenna resistance and the radiation resistance change with the wave-length. A very low resistance in the antenna wires is not as important as it might seem to be, as it has been shown both by theory and experiment that in general the radiation resistance is many times the resistance of the wires themselves. A typical curve of total antenna resistance is shown in Fig. 10, where it is seen that the resistance is greatest near the fundamental wave-length of the antenna and is smallest at a wave-length about one and a half or two times the fundamental. It is at or near this point that many stations work most efficiently.

When steel towers are used, they are generally heavily insulated at the base, but provided with switches for grounding, when desired, as in lightning storms, etc. In some cases the station becomes more efficient in transmitting if the tower is grounded. In general, however, the result of grounding can only be told by tests at the receiving station on the loudness of the signals, and not by the reading of the hot-wire ammeter in the antenna of the transmitter.

The disposition of the lead-in wires is also of importance. Contrary to the

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frequently observed method of keeping the lead-in wires separated up to the point where they enter the station, it is a better plan to bunch these closely together near where they join the flat-top part of the aerial. This reduces the capacity of the lead-in and confines most of the capacity to the elevated flat-top where the potential is highest. It also gives the lead-in a higher inductance which is a desirable aid in tuning, the tuning being sharper when the inductance is increased.

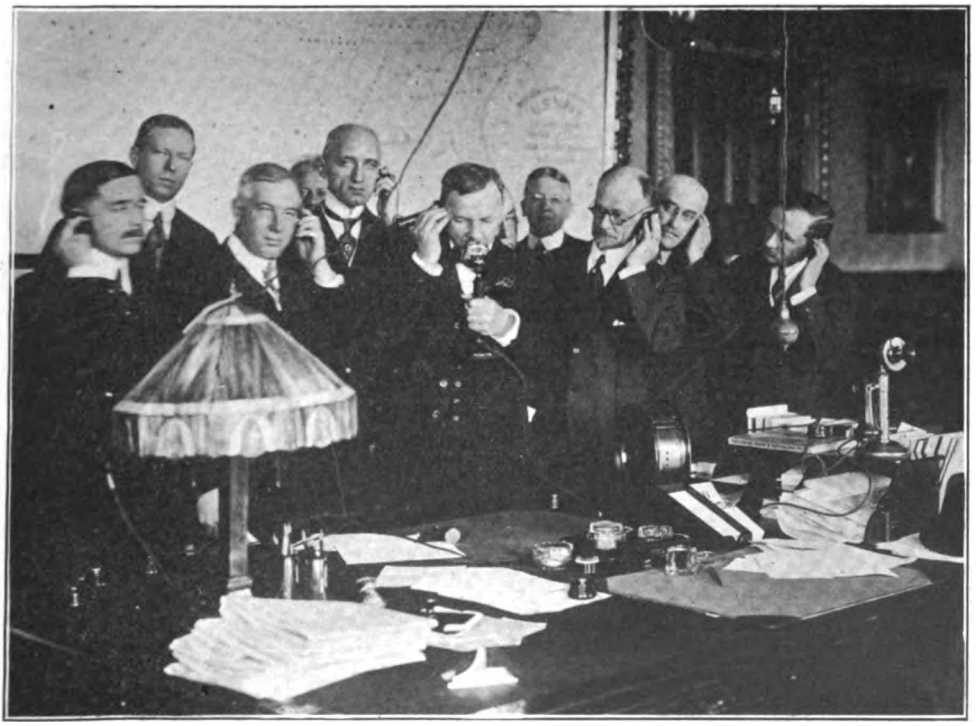
In conclusion, consideration of the points here discussed and their proper embodiment into the calculations and construction of the antenna according to the methods presented, will enable the experimenter to erect his radiating structure so that it will resist the loads imposed by severe storm conditions and will at the same time efficiently satisfy the various electrical requirements of a good antenna.

## RAILROAD WIRELESS IN CANADA

It has been announced in a newspaper that wireless telegraph will be used instead of the old poles and wire by the new Canadian government railway which is to connect Hudson Bay with the Canadian Northern at Le Pas, Manitoba. The chain of wireless stations has already been constructed between Port Nelson and Hudson Straits.

The Philadelphia To-day and Tomorrow Civic Exposition was opened May 15 by a wireless message from President Wilson to George W. Norris, president of the board of managers.

## The Naval Wireless Telephone Test



*The wireless experts and Secretary of the Navy Daniels in Washington holding wireless telephone conversation with the battleship New Hampshire at sea off the Virginia Capes, and with the station at San Diego, Cal.*

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## VESSELS RECENTLY EQUIPPED WITH MARCONI APPARATUS

| Names | Owners | Call Letters |
|---|---|---|
| Aloha (S. Y.) | Commodore A. C. James | KYH |
| Hiram B. Everest | Vacuum Oil Co. | KRS |
| Brammell Point | Vacuum Oil Co. | KRO |
| Bayamon | Vacuum Oil Co. | KDX |
| Rawson | Oriental Navigation Co. | LML |
| Buyo Maru | Standard Oil Co. of New York | JBY |
| Venezuela | Pacific Mail Steamship Co. | WBG |
| Columbia | Pacific Mail Steamship Co. | WBH |
| Ecuador | Pacific Mail Steamship Co. | WBN |
| Nevadan | Garland Steamship Corporation | WKZ |
| Westoil | Standard Oil Co. of New Jersey | KJT |
| Hazel Dollar | Robert Dollar S. S. Co. | VEE |
| Mooremack | Moore & McCormack Co. | WCL |
| Gettyburg | Moore & McCormack Co. | Not assigned |
| Josephine (S. Y.) | Joseph Widener | KZU |
| Aztec (S. Y.) | A. C. Burrage | KZC |
| Tintoretto | Lamport & Holt | ZNM |

## THE SHARE MARKET

New York, June 6.

During the past month the shares of the Marconi companies were inactive with slight gains in the English stock and fractional declines in the Canadian quotations, the market closing stronger in the American shares. In the Dominion, the buying movement that lifted the bid price above 2 has apparently subsided. On the New York Curb, notwithstanding the expression by some of disappointment at the non-payment of a dividend, it was generally considered that under the conditions imposed by the world-war, such conservatism is to be commended and dealers say that they expect more activity and a rise in price.

Bid and asked quotations to-day: American, 3-3⅜; Canadian, 1¾-2⅛; English, common, 10-12; English, preferred, 9-11.

## MARCONI MEETING POSTPONED

Owing to the lack of a quorum, the meeting of the Marconi Wireless Telegraph Company of America, scheduled for twelve o'clock, noon, on May 17, was postponed sine die. There was little business to be transacted except the election of directors to take the places of those whose terms expire; under the law these hold over till the next annual meeting.

## SPANISH RADIO TELEPHONE

A company has been organized in Spain, according to newspaper report, for operating wireless telephone systems in Spanish cities, also to connect with Spanish vessels at sea and with the Spanish possessions in Africa. It is proposed to erect wireless stations at Cordoba, Seville, Cadiz, Huelva and twenty-nine other places.

The government of Holland is said to be planning to establish direct wireless communication between the home country and the Dutch East Indies, to supplement the present cable.

The government of Portugal is reported to have planned an extensive system of wireless telegraph stations to link Lisbon with its colonies and other European capitals.

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# Queries Answered

Answers will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all letters and only one side of the paper written on; where diagrams are necessary they must be on a separate sheet and drawn with India ink. Not more than five questions of an individual can be answered. To receive attention these rules must be rigidly observed.

**Positively no Questions Answered by Mail.**

W. J. K., Allentown, Pa., inquires:

Ques.—(1) Please state how the wave-length of an aerial is determined.

Ans.—(1) It can be actually measured by means of a wave-meter after the method described in the book, "How to Conduct a Radio Club"; the matter is also fully explained in the book, "How to Pass the U. S. Government Wireless License Examinations." We may compute the capacity and inductance of an aerial from its dimensions by means of the formula developed by Cohen which appeared in the London Electrician, February 21, 1913. In the book, "How to Conduct a Radio Club," the natural wave-length of four wire aerials, up to 150 feet in length, is tabulated.

Ques.—(2) How is the upper range of wave-length adjustments of a receiving tuner calculated?

Ans.—(2) We must first determine the inductance of the primary and secondary windings. If the inductance and capacity of the aerial are known or measured by the method described in the book, "How to Conduct a Radio Club," we may then add the inductance of the primary winding to that of the aerial itself and afterwards multiply this value by the capacity of the aerial in microfarads. We then extract the square root of the resultant product and multiply it by sixty to determine the wave-length adjustment of the antenna circuit. This method is not strictly accurate, as has recently been shown by a famous physicist. The subject is more fully explained in "The Wireless Telegraphists' Pocketbook of Notes, Formulæ and Calculations," by J. A. Fleming. A simple method for computing the inductance of the coils of a receiving tuner is given in the second edition of the book, "How to Conduct a Radio Club." In order to determine the upper adjustment of the secondary circuit, we must know the capacity of the condenser, shunted across the terminals. If the inductance is expressed in centimeters (L) and the capacity in microfarads (C) then the wave-length $\lambda = 59.6 \sqrt{L C}$.

* * *

P. E. G., Franklinton, La.:

Ques.—(1) I have a receiving tuner which, when connected to a crystalline detector, responds to stations using long and short wave-lengths, but when connected to a vacuum valve detector gives faint signals on the longer wave-lengths and strong signals on the shorter wave-lengths. What is the trouble?

Ans.—(1) This question has been answered in detail in previous issues of THE WIRELESS AGE. Amateur receiving tuners usually have an insufficient value of inductance for a given wave-length when used with the vacuum valve. For the vacuum valve detector the condenser in shunt to the secondary winding should have a capacitance not in excess of .0002 to .0005 microfarad. If a capacity in excess of this value is employed, the grid potential of the valve is lowered, resulting in a decrease in the strength of signals. Note the article appearing in the May issue of THE WIRELESS AGE, in which several tuners designed for a definite range of wave-lengths and a minimum value of capacity in shunt to the secondary winding are described.

Ques.—(2) Are bottles filled with water on the inside and a layer of tinfoil on the outside efficient as condensers for a transmitting set?

Ans.—(2) Yes, provided the inner and outer surface of the glass are kept free from moisture. Cover the water with kerosene to prevent evaporation and also wipe the outer surface of the jar from time to time with a dry cloth.

Ques.—(3) Will it be necessary for me to construct a special inductively coupled receiving tuner to obtain response from stations using wave-lengths between 8,000 and 10,000 meters, or can I use my present receiving apparatus, with loading coils connected in series with the primary and secondary windings, to raise the wave-length to this value?

Ans.—(3) It is probable that your present tuner has insufficient values of self inductance or mutual inductance for the best response at long wave-lengths. You are advised to construct a receiving apparatus like that described in the book, "How to Conduct a Radio Club," which was specifically designed for use with the vacuum valve detector. This circuit responds to damped and undamped oscillations and works with particular efficiency on the longer wave-lengths. The equipment is slighty complicated, but after a few trial experiments the adjustments for best operation become self-evident.

Ques.—(4) Where can I secure a diagram of connections for amplifying the signals from a galena detector by means of a vacuum valve?



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Ans.—(4) See the book, "How to Conduct a Radio Club."

* * *

C. L. Pittsfield, Mass., inquires:

Ques.—(1) Please calculate the fundamental wave-length of an aerial 145 feet in length, 45 feet in height, composed of three strands of No. 14 wire spaced 2½ feet apart.

Ans.—(1) The fundamental wave-length is approximately 335 meters.

Ques.—(2) Can you approximate my receiving range with the aerial referred to connected to an inductively-coupled receiving tuner with a primary 4 inches by 6 inches, and a secondary 3½ inches by 5 inches? I also have a small condenser and a crystaloi detector. The receiving telephones have a resistance of 2,000 ohms; the ground connection is made to the water pipe.

Ans.—(2) With this apparatus you should hear stations on the Atlantic coast from Maine to Florida; also ships at sea. If the primary winding is wound with No. 24 wire and the secondary with No. 32 S. S. C. wire the equipment will respond to a wave-length of 3,000 meters.

Ques.—(3) Where can Marconi used apparatus be purchased?

Ans.—(3) From the Marconi Wireless Telegraph Company of America, No. 233 Broadway, New York City. Excellent bargains in first-class apparatus are available.

Ques.—(4) Does the Marconi station at Cape Cod, Mass., use a continuous wave set?

Ans.—(4) No; discontinuous waves are employed, the oscillations being generated by the discharge of condenser across the spark gap.

* * *

K. M. D., No. Monmouth, Me., inquires:

Ques.—(1) I have been told that stranded electric light cord is the best wire for connecting up the various parts of a wireless receiving set. Is this true?

Ans.—(1) Stranded wire possesses a slightly lower value of high frequency resistance than a solid conductor, but it is not necessary to use wire of this diameter for the purpose. No. 18 or 20 annunciator wire or double silk covered wire will be satisfactory.

Ques.—(2) I have a two-wire aerial, 100 feet in length, the wires being spaced 8 feet apart. It is 65 feet in height at one end and 32 feet at the other. Could I obtain better results by adding two more wires and spacing them 4 feet apart?

Ans.—(2) A slight increase in the sending distance can be obtained by adding two more wires, but for receiving only, the aerial may remain as it is.

Ques.—(3) What is the wave-length of my present aerial?

Ans.—(3) Approximately 260 meters.

Ques.—(4) How far should I be able to receive with a double slide tuning coil adjustable to 700 meters, a loading coil having a value of 4,800 meters, Blitzen forty-five-plate rotary variable condenser, a fixed condenser, a crystaloi detector, buzzer, 2,000 ohm head set, etc.? My receiving apparatus also includes a Tierney test circuit resonator for adjusting the detector.

Ans.—(4) We cannot see how the loading coil, supposed to raise the wave-length to 4,800 meters, could be of any value unless a similar loading coil were connected in series with the secondary circuit, that is in series with one of the leads to the receiving detector. Unless this is done the circuits will be hopelessly out of resonance and inefficient. It is rather difficult to estimate the range, but you should hear stations, ship and shore, all along the Atlantic coast at night.

Ques.—(5) Is the enclosed diagram of connections correct for the apparatus referred to?

Ans.—(5) Yes.

* * *

A. C. F., Allentown, Pa., inquires:

Ques.—(1) Is an amateur violating the oath of secrecy of the United States regulations if he in any manner publishes the weather report or the Government press news?

Ans.—(1) We understand that the matter contained in these reports is intended for universal use.

Ques.—(2) What causes wireless signals to fade out entirely and come in strong again a little later?

Ans.—(2) This effect usually takes place when the receiving station is out of the daylight zone of the transmitting station. It has been attributed to various causes, but the problem has not been fully solved. It is often accounted for by the reflection and refraction of the wireless telegraph waves, due to the conducting surface which the rarified air presents at a space of several miles from the surface of the earth. It is undoubtedly due to causes external to either the transmitting or the receivng station. The matter has been discussed at considerable length in the Proceedings of the Institute of Radio Engineers. It has also been taken up in the more important text books on wireless telegraphy.

Ques.—(3) What is the fundamental wave-length of a two-wire aerial, 125 feet in length, 50 feet in height at one end and 20 feet at the other? The lead-in is taken from the upper end.

Ans.—(3) Approximately 300 meters.

Ques.—(4) What stations correspond to the call letters: JPR and WFD?

Ans.—(4) The letters WFD are for the steamship Iowa, of the Goodrich Transportation Company, plying on the Great Lakes. Our records include no assignment for the letters JPR.

* * *

R. J. H., Chicago, Ill., inquires:

Ques.—(1) Are the dimensions for the coils of the best receiver described on page 82 of the book, "How to Conduct a Radio Club," correct?

Ans.—(1) The dimensions given are correct and were designed for a circuit having

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a high value of inductance and a very low value of capacity. The circuits were actually tested, tried over a number of months and found efficient.

* * *

W. C. K., Melrose Highland, Mass., inquires:

Ques.—(1) What is the wave-length of a single wire aerial 132 feet in length, about 32 feet in height, with a 20 foot lead-in?

Ans.—(1) Approximately 295 meters.

Ques.—(2) What would be the wave-length of this aerial if there were two wires spaced 6 feet apart instead of one?

Ans.—(2) The wave-length is slightly increased. The value would probably lie in the neighborhood of 225 or 230 meters.

Ques.—(3) With the aerial referred to, would it be possible to receive signals from Darien, Isthmus of Panama, Tuckerton and Sayville, provided I used a vacuum valve with the proper tuning devices?

Ans.—(3) If you use apparatus like that described in the book, "How to Conduct a Radio Club," you will be able to hear the signals from Sayville and Tuckerton during the daylight hours, and Darien at night.

Ans.—(4) It is very difficult to estimate the night range of a given commercial station. This can only be determined by test and varies from night to night. Usually any of the shore stations of the Marconi Company, operating at a wave-length of 600 meters, have a night range of about 1,500 miles, and sometimes it is considerably in excess of that distance. There is no hard and fast rule to follow, as the long distance effect is governed by conditions external to the transmitting station.

Ques.—(5) What is the wave-length of a two-wire aerial, 40 feet in length, 30 feet in height, with the wires spaced 4 feet apart? The lead-in is 15 feet in length. What would be the range of this aerial with a ½-inch spark coil and a 2-inch spark coil?

Ans.—(5) The fundamental wave-length is about 125 meters and, with a ½-inch spark coil, you would have a range of from two to five miles. The 2-inch spark coil would cover from three to ten miles, the distance depending upon the receiving apparatus used at the receiving station.

* * *

L. B., Albion, Mich., inquires:

Ques.—(1) Please tell me if there has been an instrument invented for detecting and locating submarines in the water.

Ans.—(1) This is not accomplished by wireless; the presence of submarines is detected by means of a microphone placed in the water. By a series of experiments the pitch of certain types of propellers has been observed, also the probable range of sound produced by them; hence, to some extent, the nearness of the submarine to the microphone can be determined by the strength of signals received. Vacuum valve amplifiers are used to amplify the variations of current produced by the microphone.

* * *

F. S. McT., Mercer, Pa., inquires:

Ques.—(1) Should not the rheostat connected in series with the filaments of the vacuum valve be ten ohm resistance, and is not the statement that it is 100 ohms, incorrect?

Ans.—(1) The statement is probably a typographical error. It is the usual practice to employ a rheostat in series with a filament of ten ohms resistance.

Ques.—(2) I have seen the statement that from fifty to 100 cells are required in the local circuit of a vacuum valve; however, the makers of the vacuum valve detector recommend about thirty cells. How can you explain the discrepancy?

Ans.—(2) Certain types of vacuum valves have appeared on the market in which it was essential to have from fifty to 100 cells in order to secure the best results. Valves have been constructed by the General Electric Company which require from 600 to 700 volts in the local circuit.

Ques.—(3) In the book, "How to Conduct a Radio Club," the statement is made that the beat receiver described on page 82 is of the correct dimensions for use with an aerial having an actual period of about 450 meters. If the natural wave-length of the aerial is doubled, to what extent can the size of the condensers of the various coils be reduced?

Ans.—(3) A reduction in the size of the aerial will have no effect on the constants of the local detector circuit, but the dimensions of the loading coil can be reduced by a little less than one-half. The actual reduction, however, is best obtained by experiment, as the natural wave-lengths of aerials vary considerably, depending upon the nature of the structures surrounding them.

Ques.—(4) Could not the loading coils of the beat receiver described in that publication be included in the primary and secondary windings as a continuation of it?

Ans.—(4) Yes; but the receiving couplers would prove to be rather bulky and awkward in appearance.

* * *

S. E. D., Takoma Park, D. C., inquires:

Ques.—(1) Referring to the heterodyne receiving apparatus described in the February number of the Monthly Service Bulletin of the National Amateur Wireless Association, what apparatus is needed and how should it be connected in order that a crystalline detector may be substituted for vacuum valve No. 1?

Ans.—(1) The crystal detector can be connected to the circuits in the regular manner, eliminating the high potential battery and the filament battery for the vacuum valve. Perhaps better results would be obtained, however, if the size of the loading coil connected in series with the secondary winding is reduced and a larger value of capacity employed at the secondary condenser.

Ques.—(2) Are the coils L-10 and L-11 and L-12 essential?

Ans.—(2) Yes.

Ques.—(3) Can a telephone transmitter be used instead of the telegraph key to transmit beats?

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Ans.—(3) Yes; it may be connected in series with the earth lead.

Ques.—(4) What is the best resistance for a pair of wireless head phones?

Ans.—(4) The value varies with the type of detector. With a crystalline detector, the resistance should lie between 2,000 and 3,000 ohms. With a vacuum valve detector, the resistance may vary from seventy-five to 2,000 ohms. The Marconi magnetic detector employs a seventy-five-ohm receiver.

Ques.—(5) Is the diagram enclosed satisfactory for the reception of damped or undamped waves?

Ans.—(5) Yes, provided the primary and secondary windings have sufficient values of inductance for the longer range of wavelengths. The circuit you have indicated is known as the oscillating vacuum valve, wherein the wing circuit is electrostatically coupled to the grid circuit. Careful adjustment of all the condensers, A, B, C and D, will cause the vacuum valve to oscillate and by the production of beats in that circuit the signals will be amplified.

* * *

F. R. P., Somerville, Mass., inquires:

Ques.—(1) I wish to ring a bell a quarter of a mile away by means of wireless signals. Is the enclosed hook-up correct, and is the B battery essential?

Ans.—(1) The enclosed diagram of connections is quite correct and the B battery must be employed. You may receive better signals by connecting a coil of inductance in series with the receiving aerial in order that the aerial system and the coherer connected in series may be in resonance with the transmitter.

Ques.—(2) I have a ¾-inch spark coil, which gives a spark discharge of large volume and has transmitted to a distance of eight miles. How many condenser plates, 4 inches by 5 inches, coated on both sides with tinfoil, are required for best results and how large a margin should there be between the edge of the foil and the edge of the glass?

Ans.—(2) Usually about 2 plates of this condenser, connected in parallel, each plate being coated on both sides with foil, 3 inches by 4 inches, will suffice.

Ques.—(3) Please give a simple formula for finding the wave-length of an inductively coupled receiving tuner.

Ans.—(3) This subject is described in detail in the second edition of the book, "How to Conduct a Radio Club." We must first calculate the inductance of the secondary winding and then know the value of capacity to be placed in shunt. We then multiply the inductance by the capacity, extract the square root and multiply the result by sixty. This gives the wave-length of the closed circuit. We next calculate the inductance of the primary winding, also of the aerial, together with its capacity. We add all the inductance values together and multiply them by the capacity of the aerial and extract the square root of the result. After this has been done, we multiply the result by 60, and obtain the upper range wave-length adjustment of the antenna circuit.

An answer to your query concerning the number of turns of wire for a given coil can be found in the second edition of the book, "How to Conduct a Radio Club."

The information requested in your fifth query is contained in the first and second editions of "How to Conduct a Radio Club," the construction of a variometer being described in detail.

* * *

R. S. M., Hartford, Conn., inquires:

Ques.—(1) What is the upper limit of wave-length to which an aerial having a natural period of 350 meters can be raised? Also what is the lower limit of wave-length?

Ans.—(1) Theoretically there is no upper limit to the wave-length to which an aerial system can be raised by means of a series inductance, but from a practical standpoint it is not feasible for receiving work to go above 10,000 meters. Better results on the longer waves will be obtained with an aerial of increased dimensions. It is not possible to reduce the wave-length to quite one half the natural period of the antenna system. For example: Your antenna with a period of 350 meters can be decreased to a value of about 200 meters by the use of very small values of capacity of a series condenser. Viewing the problem from the opposite standpoint: By the insertion of loading coils in the antenna circuit, the impedance of the circuit is considerably increased and when the total effective resistance, R, becomes greater than twice the square root of the inductance divided by the capacity, the circuit becomes non-oscillatory. In connection with the transmitting apparatus it is not desirable to raise the fundamental wave-length of the antenna to a value above four because it usually results in excessive potentials on the antenna wires and a loss of energy due to the impedance of the coils. It has been found by experiment that in the usual case the best wave-length for a given aerial to be operated upon for transmitting purposes is twice the fundamental or natural wave-length.

Ques.—(2) What is the correct value of capacity for the variable condenser to be used in series with the antenna circuit? I have found a condenser of .0008 microfarad to be almost useless, while one of .004 microfarad worked very well indeed even with only .008 microfarad in use. The same condenser was used in both cases, the extra capacity being obtained by filling the condenser unit with castor oil.

Ans.—(2) The series condenser will have but little effect upon the antenna system unless its value of capacity is somewhere near that of the antenna system. When two condensers of unequal capacity are connected in series the resultant capacity is less than that of the smaller condenser. You will then

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understand that to have a particularly noticeable effect upon the wave-length of the antenna circuit the series condenser must be used at values of capacity below that of the antenna itself. To explain fully the phenomenon you have observed it would be necessary for us to know the inductance and capacity of your antenna system and the wave-length to which your receiving apparatus was adjusted when you found the capacitance of .0008 microfarad had no effect upon the wave-length of the circuit. It would seem, however, that if the receiving tuner possessed sufficient values of inductance for the wave-length of the signals received and, in fact, had a range beyond this value you should have heard the signals from the distant station even with the condenser of .0008 microfarad capacity. The average amateur aerial has a capacity of about .0004 microfarad and in consequence we do not quite understand why you required one of increased capacity to effect the desired results.

Ans.—(3) The great difficulty in obtaining the number of watts flowing in an antenna circuit by observing the reading of the hot wire ammeter connected in series at its base, is the fact that it is difficult to separate the radiation resistance of an antenna system from its ordinary resistance due to the wire itself. The practical determination of the antenna resistance in radiation is given on page 206 of "The Wireless Telegraphist's Pocketbook of Notes, Formulæ and Calculations," by J. A. Fleming. This is on sale by the Marconi Publishing Corporation.

Ans.—(5) We refer you to the circuit diagrams for the vacuum valves given in the December, 1915, issue and the January, 1916, issue of the National Amateur Wireless Association Monthly Service Bulletins. The circuits are for an oscillating vacuum valve which should amplify Arlington signals on your receiving tuner to a considerable extent. Duplicate, if possible, the diagram for the primary and secondary winding of the receiving tuner, as shown in the January, 1916, issue. Properly adjusted, the oscillating vacuum valve should give better signals from Arlington than the crystalline detector, but it requires some experience on the part of the experimenter to get the best results from circuits of this type.

* * *

E. W. D., Cal., inquires:

Ques.—(1) Can you give me the dimensions for an inductively-coupled receiving tuner to have a maximum wave-length adjustment of 215 meters to be used in connection with a single wire aerial of No. 18 annunciator wire, 150 feet in length? Would it be possible to arrange the construction of this tuner so that the necessary wave-length adjustments are made in the primary and secondary circuits by means of a shunt condenser rather than with a sliding contact?

Ans.—(1) The complete dimensions for a receiving tuner of this type, also the constructional details are given in the last chapter of the book "How to Conduct a Radio Club," published by the Marconi Publishing Corporation. By a little experimenting a value of inductance in both the primary and secondary windings could be located so that the necessary variation of wave-lengths could be obtained by means of the shunt condenser. For example: You might slightly decrease the number of turns indicated in the article in the book and obtain the necessary adjustment in both circuits by the condensers as desired.

Ques.—(2) Referring to the article "How to Conduct a Radio Club" in the February, 1915, issue of THE WIRELESS AGE: Are the winding and the condenser given in table No. 7 efficient as a secondary winding of a loose coupler and will they give results equal to the usual winding of tap-offs?

Ans.—(2) The coil described will give good results as a secondary winding of a receiving tuner, but in order to secure the maximum value of voltage for a given value of inductance many experimenters prefer to use No. 32 wire for the secondary windings of receiving tuners.

Ques.—(3) In the construction of the secondary winding of an inductively coupled receiving tuner, should the turns for the lower values of wave-lengths be on the end of the tube nearest the head or on the opposite end?

Ans.—(3) The construction of receiving tuners should be so arranged that only the used turns of both the primary and secondary windings are in inductive relation to each other. For example: Take the usual type of loose coupler where the primary winding is at the left hand of the box and the secondary winding at the right hand. The turns of inductance for the lower values of wave-lengths of the primary winding should start from the right hand side of the primary and continue to the left hand, while the turns of the secondary winding should start at the left hand of the secondary and continue to the right hand.

* * *

T. A. M., Brooklyn, N. Y.:

Vacuum valves of all types are applicable to the reception of damped or undamped oscillations. The fact that one maker puts a different trade name on it than the other does not affect the working properties of a given bulb. To state the length of a coil of inductance without indicating the type of circuit or at what point at a given circuit it is to be connected means nothing. To determine the possible wave-length adjustment from a coil 3 feet in length by 6 inches in diameter, wound with No. 28 S.C.C. wire, it would be necessary for us to know the values of inductance or capacity with which it is to be employed in any given circuit.

The diagram you have given in connection with your fourth query is entirely practical, but many amateur stations prefer circuits of greater simplicity.

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C. M. B., Tchula, Miss.:

It is hardly probable that the buzzing and hissing sounds which you hear on the telephone train dispatching line come from wireless telegraph stations. Wherever a telephone line is in inductive relation to telegraph or power circuits peculiar sounds are heard, due to fluctuation of current in these wires, which at times may induce the belief that radio stations are sending. In certain localities the signals from wireless stations can be heard on the telephone wires, but this is due to the fact that some part of the telephone circuit is in inductive relation to the aerial wires. There may be certain amateur stations in your vicinity which set up inductive influences in your telephone line and you should have no difficulty in determining the origin of these signals.

* * *

H. W. McK., Fulton, N. Y.:

Rather than fit your ½ k.w. transformer coil with a magnetic interrupter, we advise you to purchase a satisfactory electrolytic interrupter. The higher powers are handled more easily with the liquid interrupter than with one of the magnetic type. Get in touch with the makers of X-ray apparatus. They will be able to supply you with an electrolytic interrupter that will give fairly continuous service. We cannot tell whether or not this coil can be used as a transformer on alternating current unless we are supplied with data concerning the winding.

* * *

D. G. T., Grosse Point, Mich.:

The taps from the winding of a receiving tuner can be taken off without exposing the wires by boring a small hole at the point of connection and placing through it a loop of wire; that is to say, the winding is extended through the hole to the point on the multiple-point switch and, without being broken, led back again through the same hole and the winding continued. In this manner no bare wire is left exposed and the continuity of the circuit remains unbroken.

* * *

L. E. B., Calabar, Mont.:

A continuously operative magnetic interrupter for induction coils has not yet been devised. The sticking of your vibrator during operation may be due to a poor grade of platinum at the contact points or to irregularities in the contact surfaces. Possibly excessive value of current flows through the primary winding, which causes the contacts to heat and arc. The vibrator of a 3-inch spark coil should be shunted by a condenser of considerable capacity—at least 5 microfarads.

Your receiving equipment already responds to stations on the Atlantic and Pacific coasts; hence there are no additional statements that we can make regarding your over-all range. That you secure response at this distance indicates that you have an efficient receiving equipment.

* * *

F. B., Liberal, Kas.:

Your 2-wire aerial, 150 feet in length, with an average height of about 30 feet, has a fundamental wave-length of approximately 335 meters.

A tuning coil, 10 inches in length by 3 inches in diameter, wound with No. 26 or No. 28 wire, will permit response to wave-lengths inclusive of 2,500 meters. One of the sliders is connected to the aerial system, the second to a terminal of the detector and the third to a terminal of the fixed condenser. The earth wire should be attached to one end of the coil.

The design of step-down transformers is outside the scope of this department.

* * *

A. W. D., Tracy, Cal.:

Ans.—(1) Regarding your wave-meter: You had better hold to the dimensions of the coil given. The actual inductance of the coil depends upon the distribution of the magnetic flux, and the rearrangement of the design you have suggested will only slightly change the value of inductance. For extreme accuracy, however, it is better to employ twenty-six turns of 18 D.C.C. annunciator wire on a form 5½ inches in diameter. This can be considered as a reply to your question No. 1.

Ques.—(2) Can not the balance or resonance between the open and closed circuit of a transmitter be obtained just as well with a wave-meter as with a hot wire ammeter? Can not the conditions of resonance be determined without knowing the actual value of current flowing in the antenna circuit?

Ans.—(2) Yes; the circuits are in resonance if they are individually adjusted to the desired value by means of a wave-meter. This subject was discussed in the article on "How to Conduct a Radio Club" which was published in the February, 1916, issue of THE WIRELESS AGE.

Ques.—(3) What is the best material for the vibrator spring on an induction coil? What gauge brass spring would be suitable for a 3-inch coil?

Ans.—(3) A vibrator spring is preferably made of hard spring phosphor bronze strip. No. 26 gauge will fulfil the requirements.

Ques.—(4) On what wave-length was the wireless telephone conversation from Arlington carried on and could the voice be heard on an ordinary crystalline detector circuit?

Ans.—(4) The wave-length employed for these tests was about 7,000 meters. The signals can be received on an ordinary crystalline detector circuit, provided the apparatus has the right values to be placed in resonance with the wave-length of the station.

* * *

E. F. G., Charleston, S. C., inquires:

Ques.—(1) I have a United Wireless port-

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able transmitting and receiving outfit, No. 13, mounted in an oak case. What is the rating in inches of the spark discharge when used as an induction coil?

Ans.—(1) Without a condenser connected in shunt to the secondary winding the spark will bridge a gap of approximately 6 inches.

Ques.—(2) What voltage is necessary to give the maximum efficiency?

Ans.—(2) The set was primarily designed for a potential of twelve volts.

Ques.—(3) Approximately how many kilowatts or fractions of a kilowatt will this coil absorb if used as an open core transformer on 110 volts A. C. 60 cycles?

Ans.—(3) If operated on alternating current, this coil must have a reactance winding connected in series. It will then consume ½ k.w.

Ques.—(4) How many Murdock moulded types of sending condensers are required for this coil in connection with a rotary or quenched spark gap?

Ans.—(4) Five sections of this condenser connected in parallel will give the correct value of capacity.

Ques.—(5) What is the correct speed and the number of points for the disc for a satisfactory rotary spark discharger?

Ans.—(5) The disc should be about 8 inches in diameter, fitted with ten spark electrodes equally spaced. It should revolve at a speed of 2,400 revolutions per minute.

* * *

R. H. S., Rutland, Vt., inquires:

Ques.—(1) I have a hot wire ammeter with a range varying from 0 to 5 amperes, connected in series with an antenna system 400 feet in length. The apparatus of this set consists of a ½ k.w. transformer supplied with 110 volt 60 cycle primary current, a glass plate condenser and an eight-point rotary gap. I also have an oscillation transformer which allows close variation of the degree of coupling. The secondary voltage of the high potential transformer, by the way, is 13,200 volts. When I place the ammeter in series with the ground or the aerial lead, I get absolutely no deflection of the pointer on the scale. But if I connect the ammeter across the terminals of the secondary winding of the oscillation transformer I obtain a reading of 4½ amperes. The amateurs in this locality say that my signals come in very strong. To aid you in solving my problem I enclose a diagram of connections. What is the cause of the trouble?

Ans.—(1) Assuming that the high potential condenser has the correct value of capacity for this transformer, the trouble is undoubtedly due to lack of resonance in the circuits of radio frequency. The fundamental wave-length of the aerial system is about 500 meters, which is far in excess of the United States restrictions. The condenser of the closed circuit should have a capacitance of approximately .008 microfarad for operation at the wave-length of 200 meters, but you must rearrange the design of your aerial to comply with the regulations. With an aerial of the T type (the lead-ins attached to the center), the flat top portion cannot exceed 120 feet in length if it consists of four wires with the usual spacing. After you have properly proportioned the two circuits your ammeter should indicate from 2 to 3½ amperes in the aerial circuit, depending upon the overall efficiency of the set. The fact that the signals are heard strong locally is no indication of the effectiveness of the set. Even with ½ ampere in the aerial circuit your signals may come in strong at receiving stations within two or three miles. Your trouble is undoubtedly due to lack of proportion of the circuits.

* * *

H. M., Monticello, N. Y., inquires:

Ques.—(1) What is the fundamental wave-length of an inverted L aerial composed of four wires 75 feet in length with an average height of 75 feet? The spacing of the wires is 2½ feet; the lead-in is 25 feet in length.

Ans.—(1) The fundamental wave-length is approximately 270 meters.

Ques.—(2) How many discs are required for a ½ k.w. quenched spark gap discharger? What should be the dimensions of the disc?

Ans.—(2) The average amateur installation requires from eight to fourteen of these discs. Complete dimensions and instructions for the operation of a ½ k.w. quenched set are given in the article "How to Conduct a Radio Club," in the February, 1916, issue of THE WIRELESS AGE.

Ques.—(3) Where can mica rings for insertion between the plates of a quenched gap be purchased?

Ans.—(3) The commercial types of dischargers generally use a fibre ring. Those of the dimensions described in the February issue of THE WIRELESS AGE can be purchased from the Engineering Department of the Marconi Wireless Telegraph Company of America for 25c. each.

Ques.—(4) How far will a ½ k.w. Thordarson transformer transmit with the aerial described in my first query?

Ans.—(4) From thirty to eighty miles, depending largely upon local conditions and upon the nature of apparatus used at the receiving station.

* * *

W. H. B., Cameron Park, Raleigh, N. C.:

Your ½ k.w. transmitting set should permit a sending distance of about fifty miles under the best conditions. Your 60-foot aerial with a height of 60 feet has a fundamental wave-length slightly in excess of 200 meters, the value allowed by the United States regulations. You may reduce it by a series condenser or you may attach the lead-ins to the center portion of the flat top. Complete diagrams for the connections of wireless apparatus appear in the book "How to Conduct a Radio Club," published by the Marconi Publishing Corporation.

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# National Amateur Wireless Association

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A national organization of wireless amateurs was announced in the October, 1915, number of THE WIRELESS AGE. Further details of the organization are given in an address made by J. Andrew White, which was published in the November WIRELESS AGE. Reprint copies sent upon request.

## MEMBERS' EQUIPMENT.

**1st. CERTIFICATE OF MEMBERSHIP.**

The handsomely steel-engraved Certificate, with shadow background half-tone, is sealed and signed by Officers, with the endorsement of Senatore Marconi, as President. Every member will want to frame and place it alongside of his Government License certificate, two documents establishing status as wireless amateurs.

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The 36 inch aerial pennant, painted in four colors on scarlet felt, will stand long service at your aerial mast head. Every member will be proud of the National Insignia flying from his aerial.

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The National Amateur Wireless Association Pin in gold and enamel is the National emblem of the Association. The design shown on the preceding page can but faintly describe its handsome appearance in three colors and gold. The pin has a special patented hub and shank which permits it being securely fastened on the coat lapel or on the vest without turning upside down.

**4th. LIST OF RADIO STATIONS OF THE WORLD.**

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This splendid book, which has been months in preparation and incorporates portions of articles running under the same title in THE WIRELESS AGE, is re-written to cover every new development, and with a large proportion of new matter. It is the foundation stone of the National Amateur Wireless Association activities. Price of this book 50c.

**7th. MONTHLY BULLETIN SERVICE.**

It is intended to make the monthly bulletin service for members of the National Amateur Wireless Association one of the most important features of the Association. This bulletin is to be used in connection with "List of Radio Stations of the World" described above. It will carry all additions (both amateur and commercial) to "List of Radio Stations of the U. S.", issued by the Bureau of Navigation, U. S. Department of Commerce, and secured for members at 18c a copy. The Government list is issued only once a year. The Association Bulletin will keep both lists up to date for you month by month, and in addition, will carry other special and invaluable Association features not obtainable elsewhere

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THE WIRELESS AGE is the Official Organ of the National Amateur Wireless Association and will contain full reports of wireless amateur activities, both national and local. It is planned to give published recognition to individual amateur achievement.

## CONCESSIONS:

Those who, *during the past six months,* have become subscribers to THE WIRELESS AGE, or have renewed their subscription, or have purchased any portion of the Membership Equipment, may consider such payment as partial payment of Membership Application as given below. If you have paid for a subscription to THE WIRELESS AGE which includes books which are not a part of the Membership Equipment, then you may credit $1.25 of the remittance as partial payment on the Membership. For example, you may have remitted $2.25 for the combination offer of the 1915 Year Book with one year's subscription to THE WIRELESS AGE. In this combination, the price of both the book and the subscription was reduced, to make the special offer; therefore, you may be credited only with that part of the payment which went to the magazine—that is, $1.25. *Coupon subscribers receive no credit for trial orders.* Subscribers to THE WIRELESS AGE who *began or renewed more than six months ago,* will secure through Membership dues a renewal for another year; and their subscriptions will be extended for one year from the time the present subscription expires.

## INITIATION FEE

An initiation fee of $1.00 is required of all new members to pay for the initial membership equipment, consisting of Nos. 1, 2, 3, 4, and 5.

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The annual dues are to be not more than $2.00. For this, all members are to receive:

1st. The Monthly Bulletin Service.

2nd. THE WIRELESS AGE for one year.

3rd. How to Conduct a Radio Club or equivalent.

**4th. 10% discount on any book on wireless published, and other features to be announced later.**

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**SPECIAL NOTICE REGARDING CORRESPONDENCE.**

As the National Amateur Wireless Association is in no sense a money making enterprise, and as the nominal dues will cover a very small amount of handling expense, it is desired that the correspondence be limited to only the most essential necessities. A cordial invitation is extended to all club officials to write on matters pertaining to organization. This invitation also includes those who are interested in starting new clubs.

**Charters** Out of the amount paid by each member for annual dues, it is purposed to allow organizations that have become part of the National Amateur Wireless Association a rebate of 50 cents out of each $3.00 for their own treasury—a fund to take care of local expenses. Please note that this is a rebate, not a deduction. In order to qualify for recognition as a unit in the National Amateur Wireless Association, a club must have at least five active members and at least one-quarter of its total membership become members of the National Amateur Wireless Association. Clubs securing a charter will have representation in the National Council; this means that they elect their own delegate and thus secure a voice in the management of the Association and in the planning of its future development and activities.

**Clayton E. Clayton, Managing Secretary,**
**450 4th Ave., New York.**

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**Checks and money orders should be made payable to: Natl. Amateur Wireless Assn.**

**APPLICATION FOR MEMBERSHIP.**

CLAYTON E. CLAYTON, Managing Secretary,

NATIONAL AMATEUR WIRELESS ASSOCIATION, Date.....

450 4th Avenue, New York City.

As I desire to receive full recognition as an amateur wireless worker of the United States, I ask the privilege of enrollment as a Member in the National Amateur Wireless Association and request that you send me the complete Members' Equipment for which I enclose herewith remittance of $1.00 Initiation Fee, covering Initial Equipment, and $2.00 for First Annual Dues—or $3.00 in all. Option.*

I trust that you will act upon my application promptly and forward the equipment to me at the earliest possible date.

My qualifications for membership are given in blank spaces below.

Signature ..... Age.....

Street Address .....

Town and State.....

Please credit me with $..... paid for.....

* Option.

In the event that an applicant is unable to send the entire amount of the membership dues with this application, the figure $3.00 may be crossed out and $1.00 written in its place. This will be considered an agreement on the part of the applicant accepted for Membership that the balance of dues ($2.00) will be paid at the rate of 50c per month for the next four months, at which time pin, pennant and Certificate of Membership will be issued. The other equipment will be sent at once.

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2—If you are under 21 years of age, give names of two adults for references as to character.

Reference.....

Reference.....

3—If you are a member of any Local, State or Interstate wireless club or association, give its name, and name of Secretary with address.

.....

4—Are you now a subscriber to THE WIRELESS AGE?.....

5—If you already have any books included in the equipment, state which ones.....

.....

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# National Amateur Wireless Association

A DIRECTING ORGANIZATION DEDICATED TO THE PROMOTION OF RADIO COMMUNICATION

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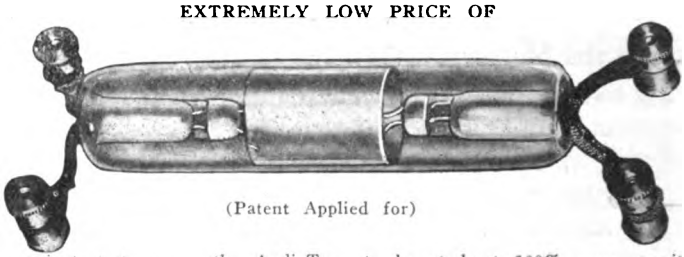
**$5.25**  **$5.25**

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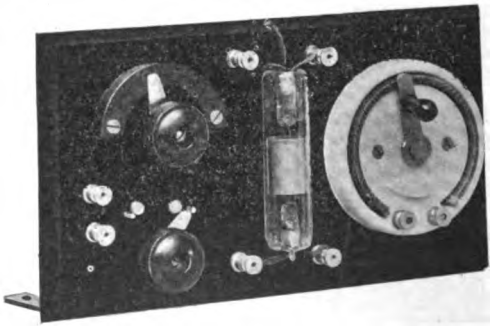

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# THE WIRELESS AGE

Owing to the fact that certain statements and expressions of opinion from correspondents and others appearing in these columns from time to time may be found to be the subject of controversy in scientific circles and in the courts, either now or in the future, and to sometimes involve questions of priority of invention and the comparative merits of apparatus employed in wireless signaling, the owners and publishers of this magazine positively and emphatically disclaim any privity or responsibility for any statements of opinion or partisan expressions if such should at any time appear herein.

AUGUST, 1916

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# The Place of Wireless in Preparedness

SIGNIFICANT of the rapid progress made in wireless communication which has placed that method of transmitting intelligence foremost in time of war, is the recent utterance of Brig. Gen. Scriven, Chief Signal Officer, U. S. Army, who has said "the enormous importance of radiotelegraphy in military affairs" is recognized by all army men and "great attention is and has been given recently to this method of communication." This means, in effect, that those responsible for the safety of the nation realize that both in land and sea strategy the nation with the best developed system of radio communication will possess an enormous advantage over any enemy otherwise equally equipped. Obviously, the time to prepare the system for high efficiency is before the outbreak of hostilities.

Comprehensive plans for the prompt acquisition of all coast stations have already been worked out and experienced men have been registered to serve as volunteers to man and manipulate these equipments. The value of these coast plants will be mainly dependent, however, upon the protection afforded them. This is the army's problem. Gen. Scriven observes in this connection: "It appears, should war arise, the country must be prepared to prevent throughout the vast extent of its seaboard the seizure and occupation of any one of the many important points, both fortified and unfortified, and of all its harbors and landing places useful to an enemy." A large and effective mobile force of troops placed at strategic positions of the coast has been planned for this work. "It should be evident," continues the Chief Signal Officer, "that of this force the men most needed in the preliminary work of defense will not be coast artillerymen alone, but engineers, and signal troops, since the first step in mobilization will be the establishment of lines of information." This important observation is then added: "It is hopeless to suppose that the signal corps of the regular establishment can ever supply more than a leaven for the mass of men needed, or even that the militia possessing signal troops of approved efficiency can provide more than the framework of the organization that will be required; and it follows that the signal troops mobilized for war must be filled in by volunteers, and therefore by men drawn direct from civil life." Excellent and abundant material for these troops undoubtedly exists among the men engaged in the electrical and mechanical pursuits of the country, the army's authority believes, and it appears to him quite necessary that in time of peace they should be drilled in the communication methods of the army. The sum and substance of the observations is reached in the expression: "the number of men needed for the purpose will be far larger than can be supplied by any probable increase of the regular establishment."

In a phrase, the army largly depends upon civilian experts to maintain communication by radio in time of war. There are less than 1,500 men in the signal service of the regular army today.

The navy has its own radio problems and, in time of peace, has discharged them satisfactorily; but with the outbreak of hostilities this branch of the service, too, would have direct need for skilled civilians to manipulate the shore station equipment and take over the key on transports. To this end, a reserve of prospective volunteers has been created and the names and qualifications of hundreds of Marconi operators and other skilled wireless men have been registered in the records of the Navy Department.



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It is an indisputable fact, therefore, that wireless telegraphy, as an industry, is of distinct value in preparing for the country's defense. Owing to the high standard maintained in the commercial field the Americans who could be called to the colors would be found equal, if not exceeding, in efficiency, those of any hostile nation.

Bearing in mind that this efficiency of personnel is due to the progressive spirit of the commercial interests, consideration may be given to the other important factor in building up an adequate communication system—the apparatus itself.

Scientific progress must depend upon the number engaged in the art, and the possibility of reward must remain the determining factor in attracting the proper talent to the field. Wireless communication has existed but a score of years; in this infant industry much still remains to be done in increasing the efficiency of apparatus. Adequate reward for inventors and business men can come only through commercial applications of wireless in time of peace; the stimulation of competition and the opportunity for commercial gain and financial reward are essential to its rapid development. Large sums of money have been honestly invested in the business, and scientific progress has kept apace of commercial expansion.

To eliminate or hamper that commercial expansion would appreciably weaken the preparedness plans of the whole country. Placing radio communication under Government monopoly control in time of peace, for instance, would do irreparable damage to the art itself by arresting the development which naturally follows where business interests must keep abreast, and even ahead, of the times to succeed. The routine duties of Government departments, military or civil, do not permit the same care and attention that is secured in industrial organizations, nor is the money for development forthcoming from the legislature as it is when private capital is given the opportunity to participate in possible profits. Wonderful scientific achievements have been registered in the wireless field during the twelve months past; substantial increases are noted in the number of stations—which the country may sorely need some day—and everywhere the commercial hand dominates the progress of the art. For the safety of the nation, these advances should be encouraged.

Government monopoly of radio communication is the one thing the people do not want. In the past they have cried it down as a deadening influence in the maintenance of public message service; now it is being as rapidly recognized as a deterrent to the execution of broader policies of Americanism, as the one influence which would retard scientific progress, lessen the number of communication points and weaken the reserve forces so essential in time of emergency. From the preparedness viewpoint, the wireless industry is too important to be meddled with.

## IOWA WANTS WIRELESS FOR NATIONAL GUARD

Adjutant General Guy Logan, of the Iowa National Guard, believes that Des Moines should have a wireless station established by government similar to that at Omaha, but as yet no steps have been taken to secure one and Uncle Sam has said nothing to show that the Iowa guard is to be thus favored. "We are," he said, "ready to organize a wireless corps aerial division or any other branch of service the war department may indicate."

## N. A. W. A. SET INSTALLED IN CAMP

The wireless station of the National Amateur Wireless Association in the camp of the Interstate Military and Athletic Encampment Association, at Birchwood Lake, Monticello, N. Y., has been installed. A 2 k.w. Marconi set was loaned to the National Amateur Wireless Association through the courtesy of Edward J. Nally, vice-president and general manager of the Marconi Wireless Telegraph Company of America, for use in the camp.

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*National Guardsmen being instructed in wig-wagging at Camp Whitman*

# The Epic of the Mexican Border

## How History in the Making is Being Recorded by Wireless Telegraphy

"THAT army radio service is a wonder," exclaimed an enthusiastic experimenter the other day. "I confess, I never knew what wireless telegraphy really meant until I began to read the radio messages from the Mexican border. They have all the tang of the wilderness, the mountain and the desert. What makes them so vivid and real? I suppose it's because they're written on the spur of the moment, by men on the firing line or hot on a bandit trail.

"Why, wireless is telling us the whole of that story, and it couldn't be told better. I still remember how Villa was located by radio, and as a matter of fact, those radio messages chased the bandit for the whole 200 miles south across the desert and into the mountains of Chihuahua. But the most remarkable feat was the way in which the wireless heralded the escape of Captain Morey, the only officer to survive at Carrizal. Why we all gave him up for dead—supposed he had died in that water hole in the desert where he wrote his report of the battle on scraps of crumpled paper. Then all of a sudden comes a wireless from 'somewhere in Mexico' telling us that he's back on the line, safe."

It is a fact that from the day in early March, when the half-breed Mexican bandit, Francisco Villa, raided Columbus, New Mexico, with his men, to the time of the present writing, Mexican border history has been in the making by means of the radio service. The whole succession of events, heroic, tragic, humorous and grotesque, that has occupied the undivided attention of the two Americas for the last four months, has been detailed, elaborated and recorded by wireless telegraphy. The radio message not only told of the punitive raids on straggling bandit bands in the mountains of Chihuahua; it even directed the strategical dispositions of the American expeditionary forces.

The finest testimonial to the value to the United States Army of the wireless service was presented when Brigadier General George P. Scriven appeared be-



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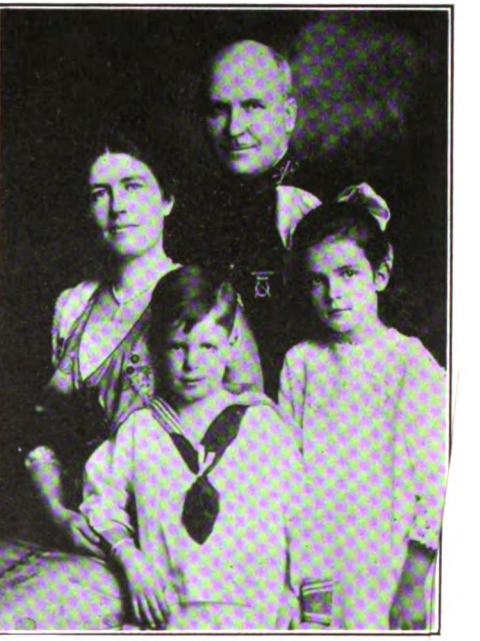
fore the House Committee in Washington, and testified to the urgent need of money for radio service and the installation of wireless plants at permanent army stations, in order that a perfect and complete wireless service might be es-

*Captain Lewis Sidney Morey, the only American officer who survived the engagement at Carrizal*

tablished across the Continent and along the border. In the Urgent Deficiency Appropriation Bill reported to the House, the sum of $250,000 for the Signal Service and $60,000 for radio installation on the border were included. The Senate is urging much larger sums for both purposes.

It was on March 9 that news came of the slaughter of seventeen Americans at Columbus by the Villistas, and eleven days later there arrived the first direct news by wireless from our army in Mexico, telling of the whereabouts of the bandits who had perpetrated the massacre. General Pershing was then on the way to hunt them down. The American Army, in fact, had invaded Mexico two days before, on March 18. After a march of more than 110 miles into Mexico, in the record marching time of forty-two hours, which would indicate a speed of about thirty-eight miles a day, the American punitive expedition had received information locating Francisco Villa, the object of their chase.

On the following day, March 21, it was reported from General Pershing's headquarters in Mexico that six biplanes of the First Aero Squadron, under the command of Captain B. D. Foulois, had arrived to scout in the mountains for the bandits. This despatch had been sent by wireless to Columbus, N. M. On the next day came the rather alarming intelligence that communication between the United States and General Pershing's punitive expedition in northern Chihuahua was at a standstill, due to the fact that the army wireless station at Casas Grandes had failed to operate. It was feared that if the break in the



*Captain Charles T. Boyd, of Troop C, Tnth Cavalry, and his family. The Captain was killed while leading a charge on Mexicans at Carrizal*

wireless could not be restored, it would be necessary to despatch mounted couriers to carry the official bulletins.

This fear was unfounded, however. They still came in, those radio messages headed "Field Headquarters, United States Punitive Expedition, Casas

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Grandes, Mexico (by Wireless to Columbus, N. M.)," that were being followed with breathless interest by the country. It was reported this time that General Pershing was returning to Casas Grandes with the news that Francisco Villa was still in retreat. The bandit had abandoned eighteen wounded men, but was swelling his command by kidnapping boys. And in another wireless from Colonia Dublan to Columbus, the

ters and by wireless to Columbus." And each despatch betrayed the strain, the efforts, the desperate marches and drives that the American troops were making to overtake the bandits who had reached their obscure and difficult mountain lairs:

"Preparations for closing in on Francisco Villa in a quick cavalry drive are being rushed forward rapidly at Field Headquarters."

*United States troops, with signalman in rear, climbing a sand dune in the Chihuahua desert while on a Mexican bandit trail*

General took the opportunity to compliment the stamina and the spirit of the American troops composing the expeditionary force.

The radios still continued to come in as the Americans advanced mile by mile further into Chihuahua. They came "By Wireless from Colonia Dublan;" then from "Namiquipa, by aeroplane to Casas Grandes, thence by radio to Columbus;" then from the "Camp of the Commanding General at the extreme front, by aeroplane to Field Headquar-

"Since the Guerrero fight, Villa has not been found. It is not known whether he fled north or south, but probably went north. It snowed to-day."

"Hopes of the American cavalrymen under Colonel George A. Dodd, of finding Villa among the snow-clad slopes of the Continental Divide, are based on the discovery of carriage wheel tracks in a mountainous waste."

"General Pershing, fearing that Villa has fled where horses cannot follow, is

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*The crack Tenth Cavalry on the march. Two troops of this regiment distinguished themselves by their daring when unexpectedly attacked by Mexicans at Carrizal*

training detachments of infantry for mountain work."

The American troops were confronted with as difficult a problem as ever faced determined soldiers. The bandits were now in their own native districts, used to country and climate. The Americans kept on doggedly and persistently, through the snowy blasts of mountain roads, through the stifling heat of waterless desert lands.

Still the ether waves came in from the desolate country, telling of the American Army's advance:

"Camp of General Pershing, by aeroplane to Colonia Dublan, and by radio to Columbus, April 3.—American cavalrymen encountered a fleeing force of Villa men near (deleted) early to-day and sounds of firing have been heard from that direction."

"April 5.—A squadron of the Tenth Cavalry, under the command of Colonel W. C. Brown, has attacked Villistas eighteen miles south of Bachiniva and duplicated the performance of the Seventh Cavalry at Guerrero."

"April 10.—General Pershing pushed forty-eight miles by automobile and camped outside of a squalid Mexican railroad town, not far behind the advance cavalry."

Thus ran the messages. Significant developments were impending. The fortunes of the American expedition were taking on a new and more sinister phase. The wily Aztec, after having agreed to co-operate with the American troops, had permitted them to penetrate, unopposed, more than 200 miles into the desolate and inhospitable country. Now he began to show his teeth and threaten.

And again the radio was the first to inform the country of this change in international relations. Army aviators returned to General Pershing's camp after a successful flight from Chihuahua City, where they delivered messages from General Pershing to General Gutierrez, the Mexican Governor of Chihuahua. A

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contingent of 650 United States cavalrymen, the largest concentrated camp at the front in the campaign, were still holding Santa Cruz ranch, north of Parral. But army officers stated that Major Frank Tompkins had received a written threat from General Lozano, commander of the Carranza garrison at Parral, that the American troops would be attacked if they advanced to the city.

The pursuit of the bandits was not halted, however. The wireless recorded that, headed by General Pershing, the American cavalry columns had completely penetrated Chihuahua to the southern extremity of the territory, where Villa's strength was greatest. Then came the news that Carranzista soldiers were evacuating the Guerrero district and concentrating in Chihuahua, ostensibly not to hamper the Americans. In the meantime, Major Robert L. Howze, after penetrating south of the Durango line, reported that he had cumulative evidence that Villa was alone and had turned westward to the mountains south of San Boya.

The radio, on April 26, reported to Columbus that Colonel George A. Dodd's column had met a rear guard of Villistas, numbering 200 under Cervantes, Baca Rios and Dominguez, near Tomachic. The American troopers were outnumbered, but drove the enemy into the hills, scattering them in a running fight that lasted until after dark. Two of our troopers were killed and three wounded in the engagement. The shifting of the Carranza troops continued. Chihuahua merchants who reached the American headquarters verified reports that Carranzista troops were being sent back to the Guerrero district. In the meantime, Colonel Dodd's column, which had continued for six days its pursuit of the Villa bandits, under their four leaders, through the rocky defiles of the Continental Divide, returned to its base at Minaca. This ended the operations for the month of April.

The first radio message in May contained the significant statement that General Pershing was anticipating every possible future development. P. H. Holly, a wealthy American rancher of El Paso, Texas, who was serving as a scout for the American expedition, was killed by Villistas, and his body, striped of arms and ammunition and valuables, was discovered near Rubio. After this murder, the wireless reported that rumors were being mysteriously circulated in Chihuahua of a probable withdrawal of the American troops. Such reports were prevalent among the natives even in remote cattle ranches and created much nervousness among the peons inclined to be friendly, who feared that if the Americans left the country they would be punished for selling beef and other supplies to "amigos de la patria."

Another exploit of the column under Major Howze was reported on May 6, from Namiquipa to Columbus by wireless. It stated that the Major, with 240 men of the Eleventh Cavalry, engaged Villistas under Cruz Dominguez and Julio Acosta, near Ojo Azules, killing forty-two, by actual count, and driving the remainder, half-clothed, to the hills. The scene of the fight was about twenty miles southeast of Cusihuiriachic. It was also reported by radiogram from Manzanillo, Mexico, to San Diego, Cal., that Mexican bandits, believed to be followers of Villa, were very active near Colina and in the Guadalajara region.

El Paso is the home of all kinds of mischievous rumors. One of these now raised the ire of General Pershing, as recorded in a radio message from Lake Itascate to Columbus, in which the General was described as seated in front of his tent, with his jaws set and his grey eyes snapping, giving utterance to a vigorous and explicit statement regarding the campaign, aroused by one of these El Paso reports that the expeditionary forces were in a feverish state of uncertainty, fearing attack.

A desultory warfare continued, as reported from day to day by marconigrams:

"May 17, via wireless to Columbus—Francisco Villa has recovered from his wounds and has been busy for some weeks attempting to raise a new army in the State of Durango."

"May 20, near Namiquipa, via wireless to Columbus—Bandits under the command of Atezutro Dominquez and Pedro Costillo, were practically annihilated by twenty-five vaqueros from a ranch at a point forty miles southwest of Madera."

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"May 22, Rancho Providencia, Chihuahua, via wireless to Columbus—Bandits are again active, though being hunted persistently by a detachment of American cavalry."

"May 27, near Namiquipa, via radio to Columbus—Candelario Cervantes, the chief Villista in northern Chihuahua was killed six miles south of Cruces near the American line of communication, in a running fight with a mixed command of a party of ten infantrymen and engineers. The fight lasted forty-five minutes."

Such was the history recorded by radiogram for the month of May. The month of June opened with efforts to renew friendly relations between the Carranzistas and the American troops. A wireless message from the temporary field headquarters to Columbus, told of a conference held between General J. J. Pershing and General Gabriel Gavira, Carranza commander in northern Chihuahua, with headquarters at Juarez They discussed the military situation in Chihuahua. A field dinner was given to the Mexican commander by the American commander, in which toasts were drunk in Mormon wine to President Wilson and General Carranza.

The next wireless message told of another fight with Villistas. Lieutenant James A. Shannon, Eleventh Cavalry, with twenty Apache Indian scouts, a reconnoissance detail, encountered a detachment of Villa men near Las Varas Pass, forty miles south of Namiquipa, after following a week old trail. The scouts engaged the bandits, wounding one and killing one. There were no American casualties. Again, on June 12, three bandits were killed and several were wounded in an early morning fight, when Captain Otto W. Rethorst, with a detachment of the Thirteenth Cavalry after a forced march, surrounded the survivors of the Candelario Cervantes band, about twenty miles northeast of Santa Clara. Then Pedro Lujan, a Villista lieutenant, and one of the leaders in the Columbus massacre, was made captive by American troopers at the Tepehaumes Hacienda, thirty-five miles east of Namiquipa.

The arrival of June 18 saw the culmination of strained relations between the Carranza Government and the United States. Bandits had again raided the American side of the border, and another detachment of troops invaded Mexico in the region southwest of Brownsville. Carranza insisted on the withdrawal of the American expedition, and General Jacinto Trevino had warned General Pershing that he would attack the Americans if they moved in any direction except to the north.

President Wilson called out substantially all the state militia of the country in connection with the Mexican situation. A message from Colonia Dublan, via army wireless to Columbus, stated that Carranza soldiers were arming Mexican civilians in the vicinity of Casas Grandes, Pearson and Madera, in preparation for hostilities with the American troops. Another radiogram stated that an American soldier had been captured by Carranza forces of the Casas Grandes garrison and held prisoner for several hours. He was released only when General Pershing sent a demand in which he warned the Mexican commander that if the soldier were held an hour longer, American troops would attack the town.

Matters were coming to a head. General Pershing's command was on the verge of hostilities, according to wireless messages from the field. A despatch from Colonel D. C. Cabell, Pershing's Chief of Staff, said that the attitude of the Carranza soldiers was such that American motor truck supply trains were in danger of being fired upon.

Then came the engagement at Carrizal. The news of this leaked out slowly, for the Tenth Cavalry on its eighty-mile mountain trip, was not provided with a radio set. The details of the story were not even fully learned when a radiogram from Casas Grandes to Columbus, reported the arrival in camp of seven men of the Tenth Cavalry, part of the unfortunate detachment, after a heart-breaking eighty-mile mountain trip. Wireless announced the escape of one more survivor.

Another radiogram from Field Headquarters at Colonia Dublan then told the story of the deaths of Captain Boyd and Lieutenant Adair, and a dozen of

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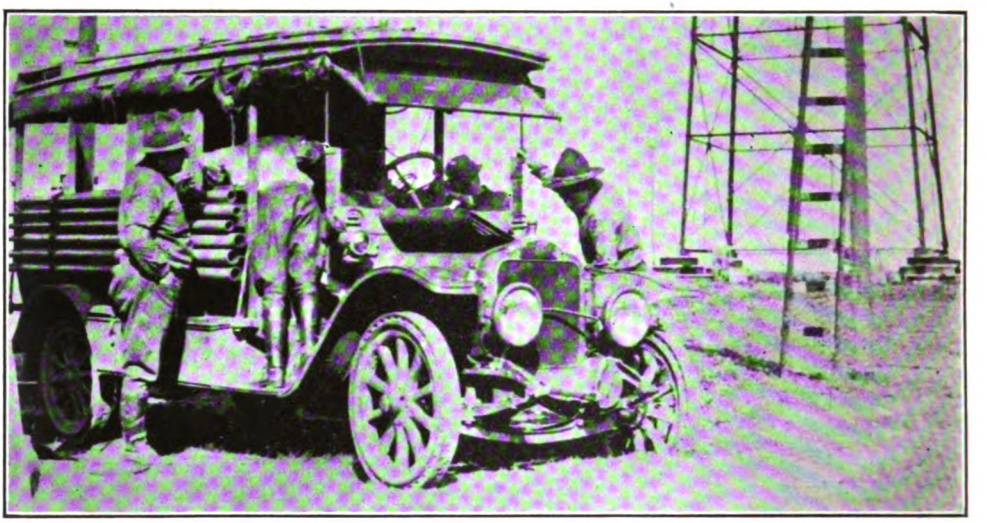
the cavalrymen, and the capture of two dozen more by the Mexicans. It was believed that Captain Lewis Sidney Morey, who had not been heard from, was either dead or a prisoner. Outnumbered, surrounded and leading a forlorn hope, the two troops, attacked by Carranzistas, had fought and died game. They had charged twice directly into the jaws of the ambush.

Later three more troopers, wounded and half-famished, straggled into camp, bearing a remarkable document scribbled on a piece of crumpled paper,. which had been written by a man lying wounded in a water hole somewhere in the Chihuahua desert. It was Captain Morey's report of the battle of Carrizal. Morey said that at the time of writing, he was hiding in a hole 2,000 yards from the field. He had instructed the three men to leave him and try to reach the American camp, and they left, believing that he must die from loss of blood and lack of water.

At army headquarters in Mexico, Captain Morey had virtually been given up for dead, when the Captain's fellow officers were electrified by the receipt of a telegram from the Captain's wife, in Austin, Texas, who stated that she had just received a wireless message from her husband, transmitted through Columbus. It read laconically: "Somewhere in Mexico—am back on the line with two men safe. Sidney."

On the following day a radiogram announced the arrival of Captain Morey at Field Headquarters. The sole officer to survive the fight with the Carranzistas at Carrizal, sat on the edge of a bunk in a thatched hut at Headquarters, and told an attentive group of fellow officers, who had gathered to congratulate him as one risen from the dead, the details of the first real tragedy of the Mexican border campaign. The negro troopers, said the Captain, had met almost certain death with smiles on their lips, as they fought their grim fight against odds.



*One of the United States Army field wireless motor trucks taking on a full field equipment, preparatory to joining the American expeditionary forces in the pursuit of Villa and his bandits*

Such has been wireless history on the Mexican border, to date.

Since then both houses of Congress have taken steps toward appropriations for defense and the proper arming and equipment of the militia forces that are being sent to the border. Large sums are provided for the Signal Service of the Army and for wireless installation. The House reported an expenditure of $250,000 for the Signal Service, and $60,000 for radio installations. The Senate has increased these sums to $1,545,490.

Brigadier General Scriven appeared before the House Committee and said:

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"We are in terrible need of money for radio tractors, trucks, field wire, telegraph poles and miscellaneous expenses."

The General then indicated on a map the lines of communication to General Pershing's position, which have been briefly reviewed in the list of radio messages published in the preceding pages. General Scriven urged the need of increased wireless installations, and intimated that the communication with General Pershing was not as complete as it should be. He said that it would take several months to install radio sets at Fort McIntosh, Fort Bliss and Fort Huachuaca (Arizona), which are intended for permanent stations. "The idea," he explained, "is to get wireless across the Continent and along the border. With the 300-mile radios they can pick up the smaller wagon sets, and it will give a pretty complete chain across the Gulf and the station at San Diego. I think that we can get the Fort Bliss set installed in two or three months. We have the material down there. I am afraid that it will take six months to install the others."

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The enomous importance of radiotelegraphy in military affairs has frequently been emphasized by General Scriven. The radio tractor in the hands of the American troops has the instruments and switchboards installed in a specially designed, covered body, which is mounted on the chassis of a commercial gasoline truck. Sufficient space is available for the transportation of a crew of ten men. By means of a special clutch and gear the engine is made to drive an alternator for furnishing the necessary electrical energy. The mast and umbrella type antenna are raised by means of a shears located on top of the tractor, and the average time consumed in erecting the antenna and placing the set in operation is eight minutes.

The tractors thus far developed are of 1 and 2 kw. capacity. Under ideal conditions, the larger set has transmitted messages for distances of 300 miles. The normal range of this type under the most trying atmospheric conditions is 100 miles. The 2 kw. tractor is intended for use at field army headquarters. Its weight without crew is about 9,200 pounds. The smaller tractor, known as the divisional type, has a range of from 50 to 150 miles, varying according to atmospheric conditions. The weight of this set is about 5,700 pounds without crew.

Horse-drawn sets, specially constructed, are provided for the field companies. Two types of skid sets have been developed. These are transported in escort wagons and similar vehicles. In the smaller (1 kw.) set, the engine and the generator are mounted on skids and can be carried by two or four men. In the larger type (2 kw.) the engine and generator are mounted on separate frames, but so constructed that they can be readily bolted together. The weight of each unit does not exceed 350 pounds. The receiving and transmitting instruments and switchboard are carried in a fiber case about the size of an ordinary trunk. When not in operation, the switchboard lies flat in the case; in use its position is vertical.

The sectional masts are similar to those used with the radio tractors; that is, 60 and 80 feet long, according to the size of the set. The receiving and transmitting instruments of the latest type of radio pack set are contained in a case slightly larger than an ordinary suit case. The transmitter is supplied with energy obtained from a 500-cycle, 110-volt, self-excited alternating current generator operated manually by means of two crank handles connected with a series of gears for turning the armature at the necessary speed. The generator and gears are inclosed in a dustproof housing, so arranged that the gears continually revolve in a lubricant. The generator is mounted on a standard. A 40-foot sectional mast is used. The antenna is of the umbrella type and consists of four stranded wires, each 85 feet long, insulated at the open ends and held by guy ropes. Instead of a direct ground connection, a counterpoise, consisting of four insulated wires, each 100 feet long, is radiated from the mast along the ground. The time required to place the packset in operation is three minutes. Its range of operation under ordinary atmospheric conditions is 25 miles.

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# Signal Corps Activities in Brief

## Recent Results of the Work of the National Amateur Wireless Association in Providing Expert Telegraphers for Home Defense

THE signaling branches of military service have, in the past few weeks, been receiving more attention than has been given in the decade which has passed since the "Service of Information" became a recognized auxiliary to modern armies in the field. Urged by the National Amateur Wireless Association, members all over the country have been organizing cadet signal corps companies for home defense, and experienced operators have heeded the call to the colors and joined with the established National Guard units.

New York members of the N. A. W. A. who first became acquainted with the local militia signal corps work and enlisted after hearing the address delivered at Columbia University last Fall by Captain (then lieutenant) Maloney, are to see service with the Mexican patrol. The First Battalion Signal Corps, N. G. N. Y., left for the border on July 5, Major William H. Hallihan commanding. The 177 officers and men left the Seventy-first Regiment Armory, Thirty-fourth street and Park avenue, at 8:15 A. M., Major Hallihan riding a fine chestnut horse, presented to him by Taylor, Bates & Co., the firm with which he is connected. The men marched to the Jersey Central ferry at West Twenty-third street, the crowds along the line applauding and several hundred relatives and friends of the men trudging behind, refusing to say good-bye this side of Jersey City, where the special train got under way at 10 o'clock.

The signal organization left New York better equipped than any unit of its kind in the Guard of this country, according to military inspectors. In addition to the members of the aviation outfit the corps also included twenty wireless operators and half a dozen complete wireless outfits. A medical staff of five men went along.

The staff officers besides Major Hallihan were Captains Robert W. Maloney, George L. Schenk, Arthur L. Howe, W. L. Kennedy, and Lieutenants Herbert L. Watson, Jerome Sullivan, Gordon Ireland, and Louis H. De Baun.

From Washington, D. C., word has been received that the sixty-five men in the Signal Corps, not mustered in with that organization because only seventy-five out of the 140 were needed to place the command on a war basis, immediately will be organized into a wireless company by J. W. Stepp, an employee in the office of the chief signal officer in the War Department.

Stepp and the men are most enthusiastic over the plans to form the wireless command and will drill and study four nights a week, so as to get to the border or into Mexico at the earliest possible moment.

Drills will be held Tuesday, Wednesday, Thursday and Friday nights in the First street armory.

Stepp is a wire and wireless operator, and also an electrical engineer. If successful, he probably will be placed in command of the company. Should this be done the District will have a signal corps battalion, and Captain Oliver Terry, of the Signal Corps, may be made a major.

It is believed that with sixty-five men already reasonably well trained in signal corps work, ten other men can be recruited within a short time and thus provide sufficient strength for muster.



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Boston has reported that its most urgent call for militia volunteers, and one that carries with it an opportunity for especially interesting service, is that for 150 men who will comprise aviation and radio companies in a new battalion of the Signal Corps. General Sweetser wired back from Rochester, while on his way to the border, that the new unit would probably be accepted as a part of the militia as soon as recruited and equipped.

The call for men, which was signed by Albert J. Litchfield of 295 Pearl Street, Cambridge, asked that men interested meet at the Cambridge Armory for organization. Men who have had service in the signal corps, or who are interested in wireless telegraphy, were most desired, it said. Skilled aviators have offered their services as instructors for the new company, and one of the officers will probably be Captain Harry Metcalf of the Harvard Flying Corps.

The project has the hearty support of militia officers, and also of Congressman Dallinger, who will request for the battalion immediate recognition by the war department.

In Manchester, N. H., on June 26, an enthusiastic meeting was held at the Young Men's Christian Association with the view of recruiting for a radio company connected with the signal service. A total of fifteen men was recruited ready for call from the Radio Defense League of New Hampshire, an organization which was among the first to become active in the work outlined by the National Amateur Wireless Association. The officers of the league are looking for a total of seventy-eight men to be drilled in this important branch of service.

At the same time, it was explained that the signal corps of the First Regiment, N. H. N. G., is in need of men experienced in reading Morse and Continental codes, and an opportunity was given for those who desired to indicate their willingness to enter the service of the present corps at Camp Spaulding.

The meeting was presided over by Chief Operator William H. Hitchcock, of the league. The previous afternoon, Operator Hitchcock, Lieutenant Starkey, Sergeant Worrall and Corporal J. T. Webber went to the field headquarters of the First Regiment at Concord. There they interviewed Colonel Healy of the First Regiment, and Lieutenant Clinton McLane of the Signal Corps. It was learned that a platoon of twenty-seven men, including in its membership experienced radio men of the league, would be most acceptable, and it was indicated that several empty officers' berths would likely fall to the more experienced men of such a platoon.

Operator Hitchcock, who is physically incapacitated for service, stated the impossibility of his responding to this call, but added that, in spite of his condition, he desired to do what he could towards a sane defense of the country. He reported in detail concerning his conferences with officers of the regiment and corps in Concord, and concluded that an unusual opportunity offered itself, not only to members of the Radio League, but to any man in Manchester, between the ages of eighteen and thirty-five who is interested in telegraphic work, or to whom the duty of a signal corps appeals. The present signal corps is a wire organization, and it does not employ wireless operators. He explained these duties in brief and showed in what ways the member of a signal corps is in an advantageous position compared to that of men of the infantry or cavalry. The importance of the work in modern field operations was also emphasized. At the end of his report, four men indicated their intentions of enlisting in the present corps.

Further opportunity for allying with the proposed platoon of twenty-seven men who will go from Manchester to this corps at Concord, was given at the Y. M. C. A. the following evening, when opportunity was also provided for joining the radio company which is being formed by the Radio Defense League.

Four members of the Lynn Radio Club have answered their country's call and enlisted in the Massachusetts Volunteer Militia, three as wireless operators with the signal corps and the other as a private in D Company, 8th Infantry.

The wireless operators with the signal corps are Corporal H. W. Leighton, 25 Walnut Street; Privates E. Lipson, 30 Overlea Avenue, East Saugus, and Robert Hanscom, of 53 Allen Avenue, Lynn, Mass.

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Permission has been granted to the Bushwick Battalion of the Twelfth Regiment of the United States Boy Scouts to install a wireless station and outfit at its headquarters in Public School No. 70, Patchen avenue and Macon street, Brooklyn, N. Y. The wireless apparatus will be in charge of Captain Walter C. Parker, who will be assisted by four wireless operators. The Bushwick Battalion now has 400 members.

# Marconi Men In Military Service Receive Pay

FOLLOWING the culmination of the Mexican crisis, the Marconi Wireless Telegraph Company of America has announced that it will hold open the positions of its employees who wish to volunteer for service in the United States military forces, and can be spared, until January 1, 1917, allowing them half pay till that date. The matter will receive further attention on January 1. The company has already enrolled a considerable number of the men in its service as a naval reserve. Employees, temporarily transferred to Government duty, who have been in the Marconi service more than one year, will continue to b protected under the company's life insurance plan and their absence will not interrupt the continuity of their service and seniority benefits. It was also announced that the company will give instruction to pupils in its wireless school in New York City without cost until January 1, 1917, and that the school will be conducted throughout the summer without any vacation period. The announcement, which was made by Edward J. Nally, vice-president and general manager of the company, follows:

"The Marconi Wireless Telegraph Company of America considers that by reason of its nation-wide activities and its peculiar adaptability to the nation's needs—perhaps greater than that of any other civil institution—it should be considered an arm of the government and in time of national stress or peril should hold itself in reserve subject to government orders and control.

"Already it has enrolled many of its rank and file as a naval reserve, having several months ago furnished the Navy Department a complete list of its employees, segregating them according to rank and experience, with particular reference to their ability to serve the country in time of war in the manufacture, supply and operation of radio apparatus.

"Having done this for the Navy, the Marconi Company is desirous of likewise serving the Army, and to the extent that it can supply capable and expert wireless men without weakening the organization it is holding in reserve for the Navy, it will be glad to do so.

"Subject, therefore, to above conditions, the Marconi Company will give its consent to any employee who may wish to volunteer for service or who may, by reason of his membership in the National Guard, be required to heed the call to serve the country on the border or in Mexico, or wherever the Government orders; and in every case where the applicant meets the usual requirements and can be spared, the Marconi Company will keep his position open and allow him half pay until January 1, 1917. After January 1, the matter will receive further attention.

"Employees of over one year's service, temporarily transferred to Government service, will continue to be protected under the Marconi Company's life insurance plan, and such absence from the Marconi Company will not interrupt the continuity of the employees' service and seniority benefits.

"Until January 1, 1917, the Marconi Company will waive the usual fee charged students in its wireless school and will instruct them without cost. The usual summer vacation will be dispensed with and the wireless school, located in the Edison Building, Duane and Elm streets, New York, will be continued without interruption. Applications from students will be received, commencing Wednesday, July 5."

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# Conducts Services in Prison Camp

The mettle of the wireless man is well exemplified by a story which comes from the German prison camp at Giesson, where Albert Victor Hardwick, formerly in the service of the Canadian Marconi Company, is confined. Undaunted by his plight, Hardwick has formed a congregation among the religiously-inclined of his companions and conducts Sunday services which are looked upon by the prisoners as the brightest feature of the camp routine.

Hardwick, who was formerly sergeant of the Victoria Rifles of Montreal, was employed by the Canadian Company prior to the war as traffic accountant. At the outbreak of hostilities he joined the colors as a private in the Fourteenth Battalion, was made a corporal while the force was in England and was promoted to sergeant of bomb throwers as a reward of merit. He had previously been decorated by the late King Edward with the Albert medal of the first class for heroism in saving an aged woman's life when she fell from a railway station platform to the track below as a train drew up. Hardwick leaped from the platform, swept the woman off the tracks and threw himself on the ground a few inches from the rails a moment before the locomotive reached the spot. He was also given the medal of St. John and Jerusalem by King George, then Prince of Wales, and was known as "The Hero of 1904." The citizens of Muswell Park (England), where he then lived, presented him with an illuminated address and a gold watch and chain suitably inscribed.

He removed to Montreal nine years ago and took a prominent part in church work, being baritone soloist and a lay reader at the Church of the Ascension. Soon after reaching prison he asked permission of the military authorities to conduct religious services for the prisoners. Not having been ordained, he was informed that the permission would be granted, if he obtained a license from his bishop. Mr. Hardwick wrote to the rector of the Church of the Ascension to send him a copy of his license as lay reader and his request came to the attention of Bishop Farthing, who caused a duplicate license to be forwarded. The Bishop also wrote to the authorities requesting that Hardwick be permitted to act according to his office. The permit was granted and Hardwick secured an organ, and formed a choir. Scotch, Irish, Indians, Australians, British and Canadians join in singing the gospel hymns. Nine Bible classes have been formed and are in a flourishing condition.

Hardwick's name appeared in a list of killed several months before it was known that he was a prisoner, and a memorial service was held at the Church of the Ascension, which was largely attended, his seat in the choir being draped with the Union Jack and decorated with a wreath. Shortly afterwards a marconigram from the London office of the Marconi Company brought information that Hardwick was still living, but a prisoner of war. He is thirty-one years old, and lost a brother in the war who was killed when his aeroplane collapsed.

## MILITARY RADIO SET DEVELOPED

A new wireless set for aeroplanes has just been developed successfully by Elmer A. and Lawrence B. Sperry. Aero experts pronounce the invention of great practical benefit in military operations.

Henry Woodhouse, member of the Board of Governors of the Aero Club of America and director of the American Society of Aeronautic Engineers, has given out the following statement regarding the new invention:

"The Sperry radio set is revolutionary in that it has a range of sixteen miles and weighs only seven pounds. Other sets weigh from two to four pounds per mile radius. It was considered that an ideal set would have a range of one mile for every pound of weight. The Sperry set weighing less than half a pound per mile radius and having a sixteen mile range, is ideal for reconnaissance and for directing artillery fire. It is understood the range of this set may be increased without increasing the proportion of the weight."

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# Key Manipulation

By Carl Dreher

Chairman of Technical Committee, City College Radio Club, New York

IT is rather difficult to impress on young operators who are desirous of cultivating a clear, even style of sending, the necessity of following certain definite rules. One reason for this tendency to learn telegraphing in a slipshod manner lies in the fact that many good operators habitually violate all the rules of sending, and "get away with it." I know a station agent on the Ulster & Delaware Railroad upstate who sends remarkably good Morse while in a standing position before the instrument table, with his back half turned to the key, at the same time exchanging sprightly repartee with the summer girls from nearby hotels. I suppose that any amateurs who happen to witness this method of transmission are eager to go and do likewise. It is much wiser, however, first to acquire a slow, steady send without sensational characteristics; the frills may be tacked on afterwards.

All operators learning to manipulate a key appear to have certain tendencies in common. Prominent among these are, first, a desire to literally "tap" the key, that is, to exert a force on it only during the downstroke, letting the spring send it up again; second, the habit of sending almost entirely with the fingers, hardly any use being made of the muscles of the wrist and forearm. The first of these faults is not very serious, because every operator discards it automatically as soon as he begins to get up speed and discovers that the only way to do so is to keep hold of the key knob lightly all the time. The habit of finger-sending is less easily detected and is much more harmful in its results. Finger-sending is almost always choppy and labored. This is bad enough, but as a matter of fact the "knuckle-sender" is lucky if he can transmit at all. He is reasonably certain, sooner or later, to fall a victim to the affliction known as a "glass arm"—a paralysis of the finger and hand muscles which compels the sufferer to turn to some other field of endeavor, such as bricklaying or piano moving, for a living.

The correct method of sending is with the forearm, the elbow being used as a fulcrum, with a small amount of wrist motion, and a very little finger work for delicate touches. This throws the heavy part of the work on the muscles of the forearm, which are obviously much better adapted for continued strains than the lighter muscles in the wrist and fingers. Club members will now understand why the operators in charge insist on the wrist-up-in-the-air method of transmission. It is, indeed, impossible to place too much stress on this point, for a cramped style of sending, once it is well fixed, is almost permanent. If anyone is not yet convinced on this score, let him go to an operator who has learned to send with a finger motion and ask him to make sixty fast v's without a break, or to shoot press at twenty words a minute for a half hour. The results will convince any impartial observer.

I shall quote some data from T. Jarrard Smith's pamphlet on the Philosophy and Practice of Morse Telegraphy:

"Work is the most easily done when the key sets so far back on the table that the elbow has a rest on the same bed. When sufficient depth of desk cannot be secured, the forearm should rest on the edge of the desk, but under no circumstances should the wrist be allowed to lie or rest upon the table; on the contrary, it should be raised therefrom a couple of inches, and move up and down in harmony with the hand, allowing the elbow or forearm, as the case may be, to act as the axis or hinge of the movement, assisted by flexibility at the wrist.

"The nature of the 'grip' upon the key should be similar to that in seizing a pen. It should be light, gentle, but even and sure. It must be firm enough to secure unquestioning obedi-

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ence of the lever, but must not be rigid. Indeed, when we say handle a telegraph key as you would a pen, we have said everything. There must be no skipping, hopping, or timidity; neither is any especial vigor required. In the downward pressure do not continue the downward motion of the hand after the lever comes to rest, in order to secure what is called firmness of contact. Such a habit, when it is attempted in rapid work, will handicap the writer. There is no time for any surplus movement. It will be found that the upholstery of flesh at the finger point is a cushion sufficiently elastic to secure this result without any laborious effort on the writer's part, if he is cool, concise and even in his pressure, avoiding convulsive impulses."

The worst thing that an experienced operator can do is to attempt premature high speed transmission. Quite a number of men have acquired permanently jerky, convulsive, ragged "fists" (the popular term for a style of sending) by efforts made to ignite the gutta-percha along the line while they were yet at a tender age. On this account, ambitions on the part of the operators who are qualified to exceed a speed of ten words a minute will, until further notice, be sternly squelched. Mention may also be made of irregularities in speed, poor spacing, etc. Nothing disconcerts a receiving operator as much as constant variations and jumps in the speed of transmission. Good spacing is largely a matter of experience and ear training.

We shall now throw over the aerial switch and discuss the matter of receiving. This is where our troubles begin. But, while I am not going to pretend that learning to "copy" is the easiest task in the world, I think I shall be able to show that it is not nearly as difficult as it appears during the first few weeks of practice.

There are really two methods of receiving signals in a dot and dash code, which we will call, for convenience, the visual and auricular methods, respectively. The visual method is the one which we use before we have become familiar with the sounds of the various letters; after this point has been passed the ear system is used. Before we proceed to an analysis of these methods, I must state that the names applied to them are more for the purpose of ready distinction than accurate description, and must not be taken literally. Furthermore, the opinions to be expressed are my own, and have no particular authority behind them; they should, therefore, be heard reservedly and with a view to criticism.

An operator receiving by the visual method has the following experience in receiving a signal:

1. He hears the sound, and memorizes it, either by ear, or, if the signal is sent very slowly, by dots and dashes.

2. The sound is resolved into visual elements; that is, the subject sees an image of the dots and dashes, and he may actually write them down.

3. The visual dots and dashes are associated with a certain letter, by the process of memory.

4. The letter is written down.

Thus we see that the visual method involves four, and possibly five, distinct mental processes.

In the auricular method only three processes are involved, as follows:

1. The operator hears the sound.

2. He makes a direct association of the sound with the letter to which it belongs.

3. He writes the letter.

Now let us see how all this psychology connects up with the experience of the operator who is learning how to receive. He is given a card and told to memorize the dot and dash symbols thereon. Inasmuch as he *sees* these dots and dashes, the association which connects them with their respective letters is going to be a visual association, even aside from the fact that most people's mental concepts are in the form of images anyhow. Then, when he *hears* the dots and dashes as sent by the buzzer, he is under the necessity of translating the sound into images before he can associate it with a letter, and as a result of this laborious and time-wasting process he is unable to copy at any considerable speeds. Until this method of copying is outgrown, therefore, progress is necessarily slow. With continued practice the operator begins

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to become familiar with the sounds of the letters, and unconsciously he begins to use the auricular method in his receiving. The transition is a gradual one. It proceeds in steps, letter by letter. The point to be noted here is that the operator can hasten the change by making conscious efforts to familiarize himself with the sounds of the letters, and by trying to copy at speeds above his normal capacity. There is nothing which improves an operator's receiving as much as the attempt to receive on circuits which are a little too fast for him. Conversely, copying on slow circuits on which no difficulty is experienced does not result in improvement. The student who realizes these facts is not the one who, when the pace becomes too hot for him, throws up his hands with a bellow of despair and breaks in with a QRS; on the contrary, he makes redoubled efforts to keep up, because he knows that improvement results only when one is pressed to the limit. Of course this principle must be kept within reasonable bounds. It is in no way a justification for sending twenty words a minute to a man who accounts himself lucky when he can copy ten. But it is a justification for tearing a man out of a five-word-a-minute rut when the chief operator is certain that he can take ten words per minute with a little increased effort.

It must not be imagined that all of the experimenter's troubles are over once he has hit on the right method of copying. We know that this is not so because frequently an operator who can copy at a moderate speed, say 15 words, is unable to do anything at all on a 20 word circuit. The difficulty in this case is caused by a slow-time reaction. The reaction time is the interval between the instant when the symbol is heard and the instant when the corresponding letter pops into the operator's mind. In general, it may be stated that, other conditions being favorable, an operator can copy at a speed for which the intervals between letters are equal to, or greater than, the said operator's reaction time to the signals. Sometimes an operator has trouble in copying because his attention is not properly fixed on each word as the distant transmitter makes it. A special case of this occurs when a receiver is so disconcerted by the fact that he has missed a letter or two that he loses the next few sentences into the bargain. All operators who work at good speeds experience this inability to keep on copying after a word has been missed, and it is only by the exercise of considerable will power that the fault can be corrected.

In theory at least all good operators are supposed to copy two or three words behind the sender. The advantage of this lies in the fact the receiver does not in that case copy the sender's errors, and has time to capitalize proper names, etc. I have heard that there are some operators who copy only at the end of every sentence, but I have never seen it done. As for the feat of reading signals without copying at all, which seems such a difficult achievement to the beginner, it is, with a little practice, much easier than formal copying. The student who intends to work on fast amateur circuits should accustom himself to this practice, first, because the conversation is seldom worth recording; secondly, because one is expected to answer as soon as the sender has finished transmitting, and the operator who copies must generally look over his notes before he knows the content of the message; thirdly, because the sending of some prominent amateurs, whose names I would mention if I dared, cannot be taken down on paper by any known means.

## PHILADELPHIA POLICE SET PROPOSED

Chief McLaughlin, of the Philadelphia Electrical Bureau, announced recently that he planned to take up with Mayor Smith and Director of Public Safety Wilson the question of equipping the City Hall tower with wireless. The idea was suggested by the installation of a wireless set in police headquarters at New York, through the efforts of the Home Defence League of that city.

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# Explanation of Weather Reports and Time Signals

The Radio Service Bulletin recently published the following regarding the transmission of weather reports and time signals by naval stations:

Through co-operation with local offices of the United States Weather Bureau, weather forecasts are sent broadcast to sea through naval coast radio stations at certain times, varying with the locality. Coast stations are generally prepared to give local forecasts to passing vessels without charge, on request. Storm warnings are sent whenever received and the daily weather bulletins are distributed by the naval radio stations at Arlington, Va., and Key West, Fla., a few minutes after the 10 p. m. time signal. These bulletins consist of two parts.

The first part contains code letters and figures which express the actual weather conditions at 8 p. m., seventy-fifth meridian time, on the day of distribution, at certain points along the eastern coast of North America, one point along the Gulf of Mexico, and one at Bermuda.

The second part of the bulletin contains a special forecast of the probable winds to be experienced a hundred miles or so off shore, made by the United States Weather Bureau, for distribution to shipmasters. The second part of the bulletin also contains warnings of severe storms along the coasts, as occasions for such warnings may arise.

Immediately following this bulletin, a weather bulletin for certain points along the Great Lakes is sent broadcast by the naval radio station at Arlington, Va., consisting of two parts. The first part contains code letters and figures which express the actual weather conditions at 8 p. m., seventy-fifth meridian time, on the day of distribution, at certain points along the Lakes. The second part of the bulletin contains a special forecast of the probable winds to be experienced on the Lakes during the season of navigation—about April 15 to December 10.

The points for which weather reports are furnished are designated as follows: For Atlantic coast and Gulf points: S=Sydney, T=Nantucket, DB=Delaware Breakwater, H=Hatteras, C=Charleston, K=Key West, P=Pensacola, and B=Bermuda; for points on the Great Lakes: Du=Duluth, M=Marquette, U=Sault Ste. Marie, G=Green Bay, Ch=

BEAUFORT SCALE OF WIND FORCE

| Number and designation | Statute miles per hour. | Nautical miles per hour. |
|---|---|---|
| 0 Calm | 0 to 3 | 0 to 2.6 |
| 1 Light air | 8 | 6.9 |
| 2 Light breeze | 13 | 11.3 |
| 3 Gentle breeze | 18 | 15.6 |
| 4 Moderate breeze | 23 | 20.0 |
| 5 Fresh breeze | 28 | 24.3 |
| 6 Strong breeze | 34 | 29.5 |
| 7 Moderate gale | 40 | 34.7 |
| 8 Fresh gale | 48 | 41.6 |
| 9 Strong gale | 56 | 48.6 |
| 10 Whole gale | 65 | 56.4 |
| 11 Storm | 75 | 65.1 |
| 12 Hurricane | 90 and over. | 78.1 and over |



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Chicago, L=Alpena, D=Detroit, V=Cleveland, and F=Buffalo.

All bulletins begin with the letters U. S. W. B. (United States Weather Bureau) and the weather conditions follow. The first three figures of a report represent the barometric pressure in inches (002=30.02); the next figure, the fourth in sequence, represents the direction of the wind to the eight points of the compass: 1=north, 2=northeast, 3=east, 4=southeast, 5=south, 6=southwest, 7=west, 8=northwest, and 0=calm. The fifth figure represents the force of the wind on the Beaufort scale, on preceding page.

In order to simplify the code, no provision has been made for wind force greater than 9 strong gale, on the Beaufort Scale. Whenever winds of force greater than 9 occur, the number representing them is given in words instead of figures, thus: Ten, eleven, etc.

EXAMPLES OF CODE

U S W B S 96465 T 91674 DB 94686 H 99886 C 01214 K 02622 P 03613 B 00065.

The transmission of time signals to vessels at sea by means of radiotelegraphy was first accomplished in the United States in 1905, and this service, enlarged and extended, has continued to the present time. This service is of the greatest value to mariners, as it furnishes a means by which the time, as given by the transmitted signals, may be compared with a ship's chronometer and the error of the chronometer found. Similar comparisons over a number of days enable data to be obtained by which not only the error may be found, but also the chronometer rate; that is, the rate at which it is gaining or losing.

The noontime signals on the Atlantic Coast are sent out through the coast radio stations by connection with Western Union telegraph lines from the United States Naval Observatory at Washington, D. C. By the operation of proper relays in electrical circuits, the beats of the seconds of a standard clock in the observatory are sent out broadcast as a series of radio dots, commencing five minutes before the time of the final

TRANSLATION, UNITED STATES WEATHER BUREAU

| Station. | Pressure. | Wind. Direction. | Force.[1] |
|---|---|---|---|
| Sydney | 29.64 | SW | 5 |
| Nantucket | 29.16 | W | 4 |
| Delaware Breakwater | 29.46 | NW | 6 |
| Hatteras | 29.98 | NW | 6 |
| Charleston | 30.12 | N | 4 |
| Key West | 30.26 | NE | 2 |
| Pensacola | 30.36 | N | 3 |
| Bermuda | 30.00 | SW | 5 |

[1] See Beaufort Scale.

U S W B Du 95826 M 97635 U 00443 G 96046 Ch 95667 L 00644 D 00842 V 01054 F 01656.

TRANSLATION, UNITED STATES WEATHER BUREAU

| Station. | Pressure. | Wind. Direction. | Force.[1] |
|---|---|---|---|
| Duluth | 29.58 | NE | 6 |
| Marquette | 29.76 | E | 5 |
| Sault Ste. Marie | 30.04 | SE | 3 |
| Green Bay | 29.60 | SE | 6 |
| Chicago | 29.56 | SW | 7 |
| Alpena | 30.06 | SE | 4 |
| Detroit | 30.08 | SE | 2 |
| Cleveland | 30.10 | S | 4 |
| Buffalo | 30.16 | S | 6 |

[1] See Beaufort Scale.

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signal. By omitting certain dots in a series, the comparison between the dots and the beats of the chronometer seconds can be checked until the instant of local noon (seventy-fifth meridian time) is reached. This is marked by a longer dot, which gives the time of exact noon. A comparison with the chronometer time at that instant gives its error referred to the seventy-fifth meridian time. Applying the difference in longitude, namely, five hours, between the seventy-fifth meridian and Greenwich, which is the standard meridian (or 0° longitude), the error of the chronometer referred to Greenwich time is determined.

Time signals are now sent out on the Atlantic Coast only through the radio stations at Arlington, Key West, and New Orleans. Signals from Arlington, which reach a zone formerly served by other coast stations, are sent out every day in the year twice a day, viz., at noon and 10 p. m., seventy-fifth meridian time. Time signals from Key West and New Orleans are sent out daily, including Sundays and holidays, commencing at 11:55 a. m., seventy-fifth meridian time, and ending at local noon.

In case of failure of the Arlington high-power station, the signals are sent out by the small set in the same station, and the stations at Boston, Newport, Norfolk and Charleston are notified, and they each send the signals broadcast.

On the Pacific Coast the time signals are sent broadcast to sea through the naval radio stations at Mare Island, Eureka, Point Arguello, and San Diego, Cal., and at North Head, Wash. The controlling clock for each station is in the naval observatory at the Mare Island Navy Yard. Signals from Mare Island are sent out every day from 11:55 to noon, and from 9:55 to 10 p. m., one hundred and twentieth meridian standard time. Those from North Head, Eureka, and San Diego are sent out daily, excluding Sundays and holidays, from 11:55 to noon, one hundred and twentieth meridian standard time.

To get the maximum clearness of signals, the receiving circuit should be tuned to that of the sending station. Arlington and Mare Island send on a 2,500-meter wave length, North Head and San Diego on a 2,000-meter wave length, Eureka on a 1,400-meter wave length, and Key West and New Orleans on a 1,000-meter wave length. With the completion of the new radio station at the training station, Great Lakes, time signals will be transmitted from that station for the benefit of shipping on the Great Lakes, as well as the weather reports for that region, now transmitted by Arlington after the Atlantic Coast weather bulletin, following the 10 p. m. time signals.

## REMEDIES FOR DISTURBING EFFECTS

Methods of minimizing the disturbing effect that wireless equipment and antennæ may have on electric service lines were referred to by A. J. Wagner at a recent meeting of the Empire State Gas & Electric Association. One remedy mentioned was to insert air-core reactors, each consisting of a 6-inch coil of about 100 turns in the service circuits on the wireless user's side of the meter. This equipment, the speaker explained, will eliminate high inductive effects which result when wireless aerials and distribution lines are parallel and close together. Conditions may be still further improved by connecting a non-inductive resistance, such as a carbon rod, of about 20,000 ohms resistance across the service circuit inside the reactors and grounding the middle point.

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The United States Bureau of Navigation has been informed by the Chilean Administration, through the Bureau of the International Telegraphic Union, Radiotelegraphic Service, Berne, Switzerland, of the opening to public service of the radiotelegraphic stations Valparaiso, Llanquihue, Frutillar and Punta Arenas.

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# How to Conduct a Radio Club

*(Especially Prepared for the National Amateur Wireless Association.)*

## Receiving Detectors for Wireless Telegraphy

**By Elmer E. Bucher**

**ARTICLE XXVI**

IN the article of this series published in the June issue of THE WIRELESS AGE various types of crystalline detectors and their circuits were described. In this article the description of detectors in which the mechanical feature predominates, and which are suitable for the reception of damped and undamped oscillations, is continued.

*Marconi Magnetic Detector*—One of the most reliable and fool-proof of all detectors in commercial use to-day is the Marconi magnetic, widely in use aboard ships. It consists essentially (Fig. 10) of the iron wire band, B (several strands of No. 36 iron wire twisted in the form of a cable), having a total length of from 18 to 24 inches which is slowly drawn through the glass tube, P, by the ebonite or wooden pulleys, W-1 and W-2, which, in turn, are set in rotation by clock work or by a small direct or alternating current motor. The glass tube, P, is wound with from 6 to 10 feet of No. 36 single silk covered wire and directly around it is placed another winding, S, of No. 36 single silk covered wire having a resistance value of about 180 ohms. The head telephones are joined across the terminals of S and they should have a value of close to 150 ohms. Immediately above the two bobbins of wire are placed two horseshoe magnets with like poles adjacent. These magnets generally have a separation between the poles of about 1¼ inches and are placed at a distance of approximately ¾ of an inch to 1 inch from the band, B.

The glass tube, P, is usually about 2 inches in length and 3-16 of an inch in diameter. The bobbin of wire for the head telephone circuit has a diameter of 1½ inches and an overall width of ½ inch.

*Operation*—When the band, B, is set into movement by the clock-work some parts of it are magnetized as they approach the south pole of the magnet and accordingly are demagnetized when approaching the north pole of the magnet; however, owing to the well-known effect of hysteresis, the change of flux does not take place immediately any part of the band is directly under a magnetic pole, but is effected at a point beyond, the final result being that the iron band is in a magnetic state which is extremely susceptible to outside changes of magnetic flux which may be caused to act upon it. When high frequency electrical oscillations from a transmitting radio station flow through the winding, P, for each group of oscillations, a momentary change in the position of the magnetic lines of force of the band takes place, which, in turn, causes a variation of movement of the flux threading through the coil, S, creating a single sound for the entire group. Thus impulses of current in accordance with the note of the distant transmitting station will be produced in the circuit of the head telephones.

*Adjustment*—No preliminary instructions for the adjustment of the magnetic detector are required, since it is only necessary that the band, B, move at a very low rate per second, usually making a complete turn in



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about two seconds. The circuit, however, in which this detector is connected is important, as the device is one of

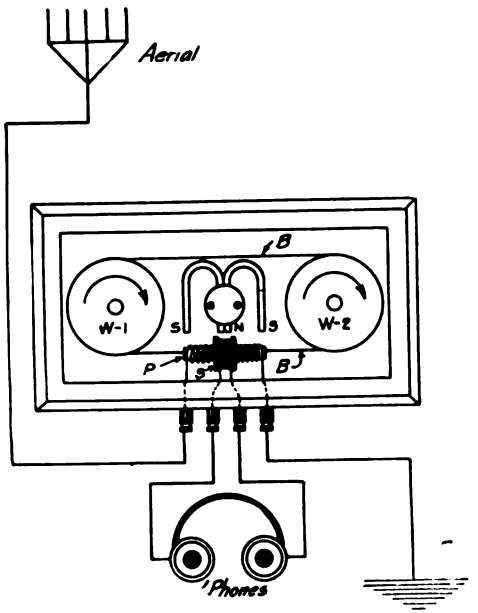


*Fig. 10*

low resistance and therefore may be, if so desired, connected directly in series with the aerial circuit. A satisfactory circuit for the detector is indicated in Fig. 11, in which an aerial tuning inductance, L-1, is joined in series with the primary winding of the detector, P, and thence extended to the earth connection, E. As indicated by the dotted lines, a variable condenser, C-1, is sometimes connected in shunt to the glass tube winding. It is then only necessary to tune the antenna to the distant transmitting station, whereupon audible response is secured.

In order to obtain the full benefit of the phenomenon of resonance, the magnetic detector is sometims connected in the circuit indicated in Fig. 12, which is a duplicate of the well-known Marconi multiple tuner. The intermediate circuit of this tuner comprises the winding, S, in inductive relation to the primary winding, P, the variable condenser in shunt, C-2, and the second inductance coil, P-1, which is in inductive relation to S-1. The secondary winding then continues through the variable condenser, C-1, to the demagnetizing winding, P, of the magnetic detector. Since, as mentioned before, this detector is considered to be a current-operated device, the secondary winding, S-1, must have rather low values of inductance and be made up of coarse wire. For example, No. 18 or No. 20 single silk covered, or Litzendraht wire, is preferred. It should be remembered in this circuit that the variable condenser, C-1, is an important part of the oscillatory circuit and changes of wave-length can be effected by very close variation of it. Usually a condenser of about .005 or .01 microfarad is employed at this point; consequently, even for wavelengths inclusive of 3,000 or 4,000 meters, the winding, S-1, may have a very few turns of coarse wire.

It has been found by experiment that the signals from 500-cycle spark transmitters are better received when the iron band, B, is set into rotation at a

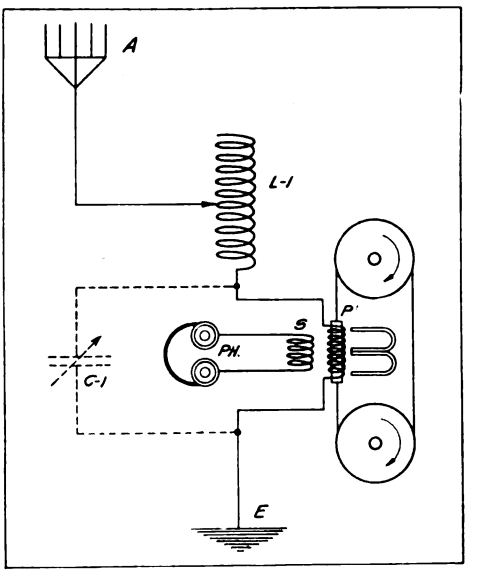


*Fig. 11*

greater speed than that ordinarily employed for spark transmitters of lower frequency. Increased results frequently can be obtained by variation of the position of the horseshoe magnet, but

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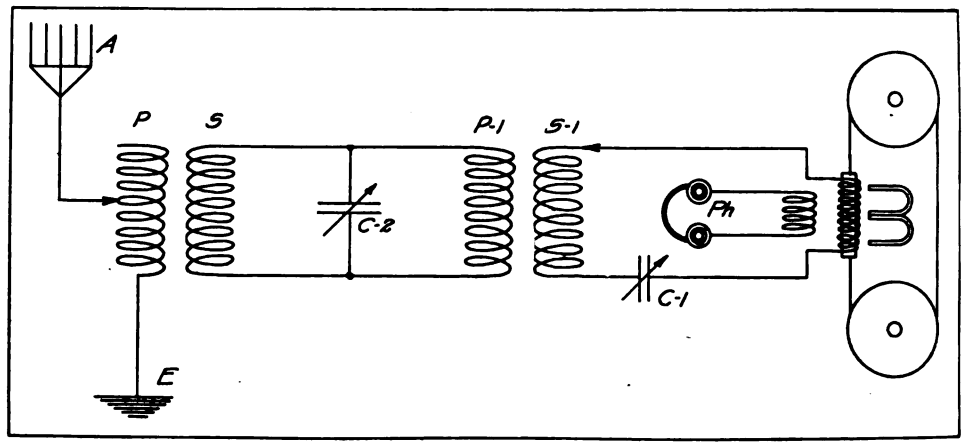


*Fig. 12*

for general commercial working they need not be moved.

An interesting point in connection with these detectors is the fact that they are more responsive to the lower oscillation frequencies, in fact the best results are obtained at wave-lengths between 2,000 and 3,500 meters.

In commercial practice the revolving band is fitted with two sets of wire bobbins placed on opposite sides of the band so that in case one set of windings is by any means injured, the second set of windings may be immediately brought into use.

*The Tikker Detector*—By reason of the fact that there are no discontinuities in the wave train of an undamped oscillation radio transmitter, it is necessary to provide means at either the transmitting or receiving apparatus to break these oscillations up into groups

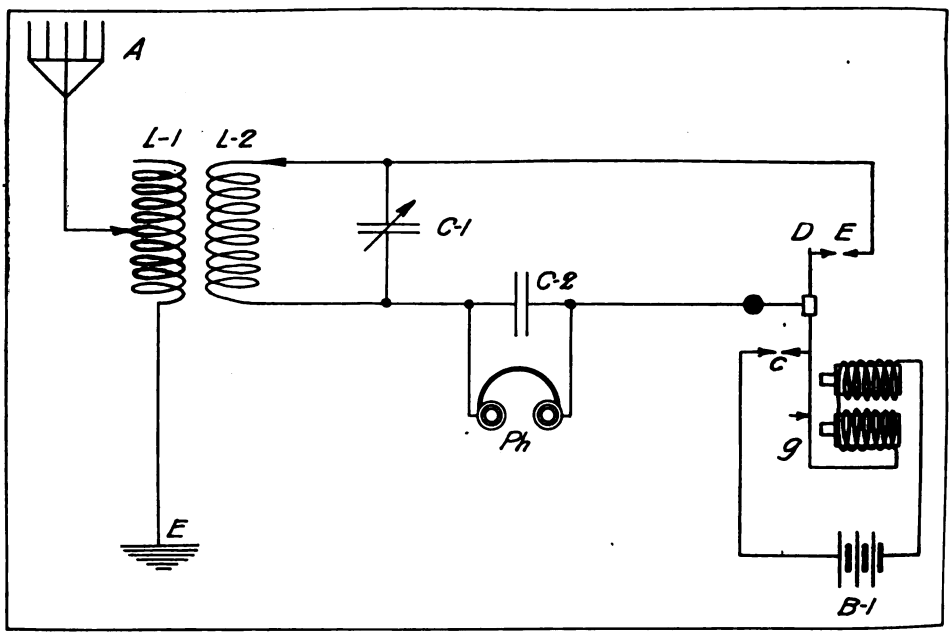


*Fig. 13*

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suitable for response in the head telephone receiver. When an ordinary crystalline detector is used in the receiving system which is in resonance with the continuous wave transmitter, no sounds are produced in the head telephones except at the opening and closing of the telegraph key, due to the fact that the continuous alternating current flowing in the transmitting antenna circuit is converted into a pulsating direct current at the receiving station. The latter merely draws the diaphragm to the receiver magnets and does not release it until the key of the transmitting station is raised.

The original tikker receiver is nothing more than a circuit interrupter mounted on a common bell buzzer. Referring to Fig. 13, the magnets of the buzzer are energized by the battery, B-1, the armature being set into vibration at the contacts. By careful design of the weight of the armature and the rigidity of the spring a very high rate of interruption per second of time can be obtained. At the end of the armature, G, is mounted the contact, D, which makes contact with the stationary point, E. As will be further observed, the last two contacts are connected in series with the secondary winding of the receiving tuner and thus periodically open and close the circuit to the telephone condenser, C-2.

When undamped oscillations traverse the receiving antenna the secondary circuits are interrupted at a rate of from 300 to 800 times per second, producing a semi-musical tone in the telephone receivers, Ph. The effect is that the energy which accumulates in the secondary condenser, C-1, is discharged at regular intervals into the condenser, C-2, which in turn discharges into the head telephones, creating an audible sound. Owing to the fact that the circuit interrupter does not break the circuit immediately at the peak of each alternation of current in the closed oscillatory circuit, a uniform note is not produced; consequently the resultant note is apt to be more or less "hissy" and not of the pure tone that could be expected from modern heterodyne circuits. A detector of this type, however, is effectual and by careful adjustment will give the desired results at any receiving station. In the original form, instead of having platinum contacts at the points, D and E, two light gold wires were placed in contact and the circuit is thus interrupted.

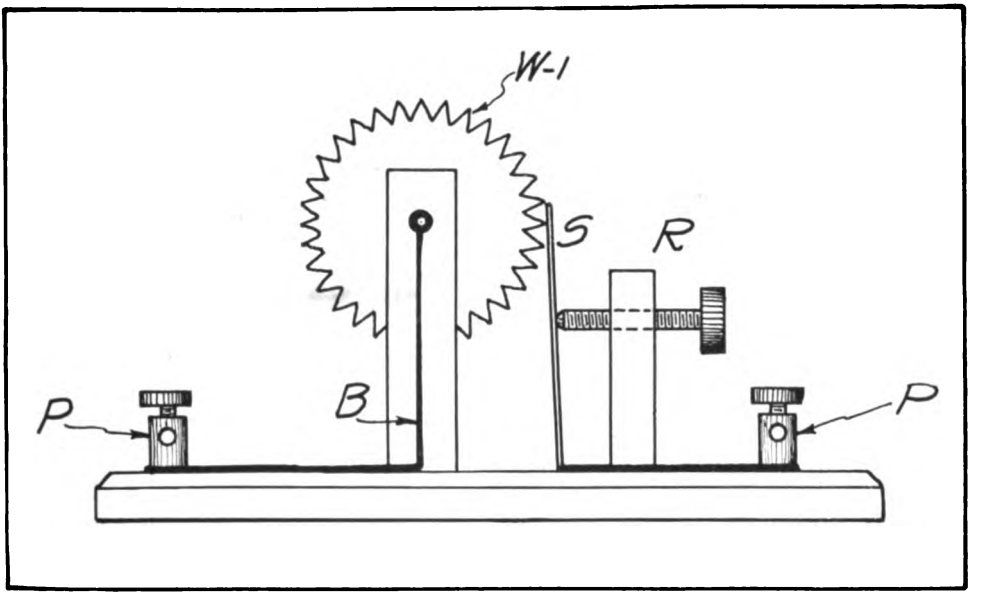


*Fig. 14*

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A modified form of the tikker is indicated in Fig. 14, wherein a toothed wheel is revolved at a certain rate per second. One side of the secondary system is connected to the brush, B, which makes contact with the wheel, W-1. The second terminal of the secondary system is connected to the brush, S, which is placed in light contact with the teeth of the wheel by means of the set screw, R. If the wheel is revolved to interrupt the circuit at a rate of, say, 600 per second, a fairly uniform note is produced. A more satisfactory arrangement is to construct a commutator interrupter of the well-known type, one side of the circuit being connected to all the bars of the commutator and the other side of the secondary circuit being connected to a brush which is in electrical contact with the bars.

tact of variable resistance is obtained, which has the effect of varying the energy which accumulates in the telephone condenser. Usually with this type of detector a more uniform note is secured than with either of the foregoing described tikkers, but still a musical note is not obtained, the resultant note being somewhat similar to that of steam escaping from a radiator.

When the transmitting station employs damped oscillations of a rather high spark frequency, any of the tikkers or a slipping contact detector may be used for receiving purposes, but of course the effect is to break up the note of the spark station, the resultant note being lower in pitch and of unstable and irregular characteristics. Certain tests made by the United States Naval Radio Telegraphic Laboratory indicate that this detector is from three to ten

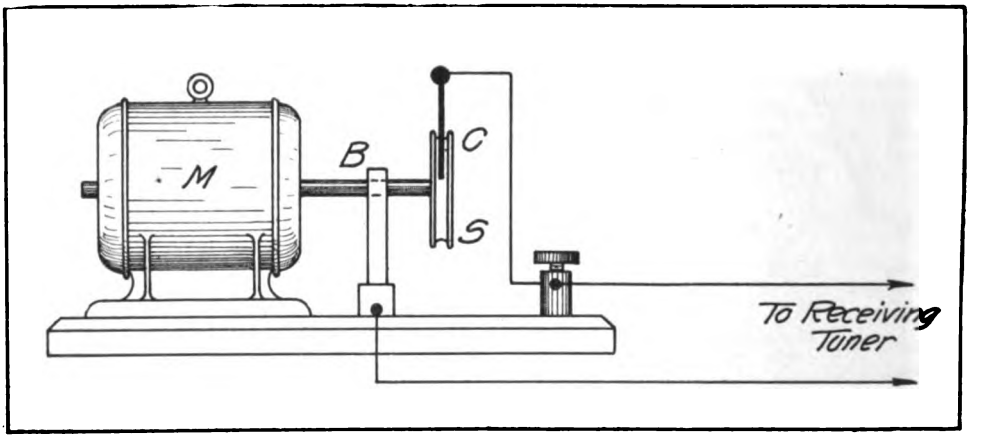


*Fig. 15*

At a later date another form of detector, known as the slipping contact detector, was devised, the essentials of which are shown in Fig. 15. In this case a small motor, M, has mounted on its shaft the wheel, S, which is about 1 inch in diameter. This wheel has a small groove in which is placed the light elastic contact, C. The other terminal of the secondary receiving tuner is connected to the brush, B, which is in contact with the shaft of the motor. Owing to the constant slipping and gripping to the contact, C, a con-

times as sensitive as the ordinary minerals.

*Adjustment*—Perhaps the most difficult to adjust of all the tikkers just described is the one indicated in Fig. 13, which requires extremely fine adjustment of the contacts, D and E, in order that a fairly uniform note may be obtained. The detectors in Figs. 14 and 15 are perhaps the most easy to adjust, the only requirement being in the slipping detector that the contact, C, be given a light pressure.

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*Circuits for Operation*—The diagram of connections indicated in Fig. 13 is suitable for any of the tikker detectors. Any receiving tuner designed for crystalline detectors will respond with the tikker. It is, however, the usual practice with these detectors to supply a secondary winding of relatively low resistance made up of Litzendraht wire or of coarse copper wire. Good results have been obtained with wires ranging in gauge from No. 20 to 24 and by means of the data given in the book "How To Conduct A Radio Club" it is easy to calculate the dimensions of a coil for a given value of inductance.

It is sometimes the practice to connect a rectifying detector in series with the tikker. It is found by experiment that it has the effect of smoothing out the note, but it decreases the sensibility of the system as a whole.

*The Goldschmidt Tone Wheel*—It was mentioned in connection with the previous types of circuit interruptors that the note was irregular, due to the fact that successive alternations of current were not broken or interrupted at the same point on the cycle. Hence means have been found by which a pure musical note can be obtained with a mechanical circuit interruptor which adds considerably to the efficiency of the device.

To understand the operation of a Goldschmidt tone wheel we must begin by assuming the following problem: Suppose, for example, that a distant transmitting station employed an alternating current to charge the antenna circuit, having a frequency of 50,000 cycles per second, corresponding to a wave-length of 6,000 meters, and assume, further, that a circuit interrupter (tikker) is devised which gives 50,000 breaks per second and is revolved at such speed so that the peak of every other alternation in the wave train is interrupted; then it is plainly evident that only one-half of each cycle of alternating current will be received in the head telephones, which will not create an audible response. Suppose, however, that the disc is run at a slightly lesser or greater speed than that necessary to obtain synchrony, the circuit being interrupted at the rate of 49,000 times per second; then every thousandth alternation of current in the aerial system is interrupted directly at the peak (in the case of a 50,000 cycle alternator at the transmitting station) and all intervening alternations are interrupted at different points on the complete cycle. The final result of this action is to produce in the telephones a beat note, or, in other words, a nearly sinusoidal alternating current of a frequency of 1,000 cycles per second. Keeping these facts in mind in order to obtain similar results with an ordinary tikker, it is only necessary to construct a tikker device with a great number of points of contact in order that from 30,000 to 55,000 interruptions of the circuit can be obtained per second of time. Of course the number of interruptions necessary depends upon the wave-length of the distant transmitting station and on the shorter wave-length, say 3,000 meters, an interruptor giving 100,000 breaks per second is required. It is found difficult to attain this speed of interruption with a mechanical device, however, and consequently the apparatus functions best on the longer wave-length corresponding to the lower frequencies.

Contrary to expectations, it is not difficult to find a satisfactory adjustment of the tone wheel, but it is highly important that the motor revolve at a constant speed, and that it be fitted with a regulating rheostat which will allow the speed of the motor to be accurately adjusted over considerable range. Then, by listening in on the head telephones when the distant transmitting station is in operation, variation is made in the speed of the motor until a musical note of the desired pitch is secured.

*(To be continued)*

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## AUSTRALIAN WIRELESS

All of the Australian wireless telegraph stations will be placed under the control of the Navy Department, it has been announced. The new service will be called the Royal Australian Navy Radio Service.

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## MARCONI MEN NATION'S DEFENDERS

Wireless men throughout the country are among those who have answered the nation's call to arms as a result of the trouble on the Mexican border. Several employees of the Marconi Wireless Telegraph Company of America obtained leave of absence from the service in order to join military companies. They include William Howard, of the Marconi Factory, at Aldine, N. J.; C. F. Enders, of the Maintenance, Repair and Inspection Department, New York, who is with the Twenty-third Regiment, New York; Richard Douglas, of the Publishing Department staff, New York, who joined the First Corps Cadets of Boston; Charles S. Gould, of the Eastern Division, operator on the Arapahoe, who took his place as a first class private with the Signal Corps of Jersey City, and Lee Lloyd, of the Gulf Division, who is with the Texas National Guard.

## JEFF. W. HAYES' BOOK

Jeff W. Hayes, the well-known old-timer and author, has just brought out an interesting and unique volume of telegraphic stories, which no doubt will meet with a hearty reception in the ranks.

It is some years since a book of this character made its appearance, and the fact that such books do appear once in a great while is evidence that operators have not yet lost their appreciation of telegraphic literature of the lighter vein.

It has the unique distinction of being at once personal and impersonal. There are many pages containing facsimile reproductions of the signatures of officials, managers, operators and other employees in many of the large offices in the country and of other persons who were formerly in the telegraph service. This feature of the book gives it a distinctive and personal character, and it is certainly interesting and "catching." Throughout the pages are scattered half tone portraits of many well-known old-timers.

The stories are, in the main, new and relate to Western life and experiences, many of the contributors being well known to the telegraph fraternity and acknowledged reputation as writ- and having acknowledged reputation as writers. Interspersed throughout the book are several poems which will appeal to those of a poetic nature.

The autographs fasten the attention of the reader and recall many pleasant memories and experiences over the wire in years gone by. Many of the names are familiar and make a character study of deep interest.

The price of the book is $1.50 per copy and copies may be obtained by addressing J. W. Hayes, 95 West Maumee Street, St. Adrian, Mich.

## SENATE DELAYS PURCHASE OF HAMMOND TORPEDO

The Senate adopted on June 30 the House provision in the fortification appropriations bill authorizing the acquisition of the system of radio control of torpedoes and vessels invented by John Hays Hammond, Jr. The House bill authorized the expenditure of $750,000 to acquire the patents and property rights in the system after an investigation by an expert board has proved the efficacy of it.

A limit of $30,000 is fixed as the amount that may be expended for the Government tests and if these prove successful the President shall decide upon the report of the board whether the system shall be acquired.

## NEW RULE FOR SHIP MESSAGES

The superintendent of Naval Radio Service has announced that effective on and after July 1, 1916, it will be obligatory on the part of senders of radiograms to be handled by the Naval Radio Service to indicate in the address of the message the class of vessel it is desired to reach by this service, such as SS (steamship), or USS (United States ship), as the case may be. Example:—John Doe, USS New Hampshire, Charleston, S. C.

This order becomes necessary owing to the confusion in proper handling of such traffic because of a large number of names of ships being the same as cities, towns, etc. The extra word will be charged for and counted in the check.

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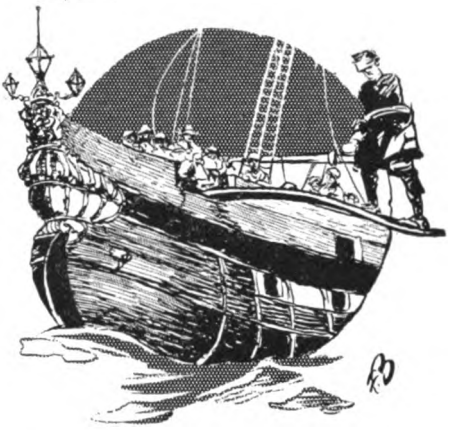
# OLD SEA ROVERS & RADIO

## THE EVOLUTION OF SWAN ISLAND



IF you sail far enough and look closely enough you will find in the western end of the Caribbean Sea a coral speck dignified by the name of Swan Island. Quite peaceful is the aspect it presents. A multitude of cocoanut trees dot its surface; in the day time the sun radiates good cheer; at night a tropical moon throws a soft light over the island and the surrounding waters, providing the finishing touch to what has been aptly termed a bit of slumbering wonderland. Tranquility did not always prevail on the island, however, for at one time it was the home of roystering pirates and the hiding place for their loot. Hardly a spot, with its glamour of buccaneer lore and out-of-the-world atmosphere, in which one would expect to find a principal earmark of progress —wireless. Yet here a station stands, its aerial and masts in striking contrast to the surrounding scenic objects.

Swan Island is 873 miles from New Orleans almost as the crow flies. Properly described, geographically, the island is 250 miles north of Colon—to be exact in lat. 17 deg. 25 min. N., long. 83 deg. 56 min. W. It is usually spoken of as one body of land—an island—although the twin sections of coral limestone and coral debris are separated by shallow water hardly 400 yards in width. Nature, however, is steadily building a connection between the tracts. The island, which was named after Captain Swan, a famous freebooter, is about three and one-half miles in length and one-half mile in width.

As the modern history of the island is linked closely to that of the Caribbean wireless service, so is its ancient history bound up with that of the old buccaneers who roamed the Spanish Main. Two hundred and fifty years ago the Spaniards had considerable difficulty in navigating their ships safely back to Europe from that part of the Caribbean adjoining the northeastern coast of South America. Far-sighted skippers would not attempt to beat eastwards against the trade winds and out across the Atlantic with the wind against them. Therefore it was the custom for masters of craft clearing from Carthagena, the Panama Isthmus and Boco del Toro to take advantage of the current and set their course northward with the Yucatan Straits as their destination. The Straits once astern, they would put in at Havana, give the crew a run ashore, take in fresh provisions, perhaps, and make their way to their home ports with the aid of the Gulf Stream and the westerly winds which are found farther north.

This was playing fairly into the hands of the pirates who lay in wait on Swan Island. For a large submarine bank



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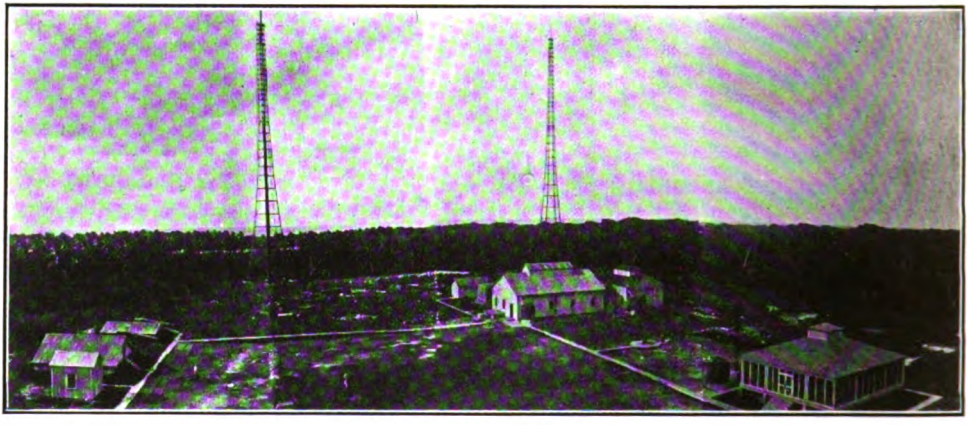
projected from the coast of Honduras extending half way over to Jamaica—a somewhat formidable peril to navigators in those days when charts were crudely drawn and good navigating instruments were at a premium. So the skippers were compelled to pass through a comparatively narrow passage, giving the gentlemen adventurers an excellent opportunity to pillage and plunder. And if the prospective victim escaped in voyaging through the passageway it is likely that he found Captain Swan, or others of his kind, waiting for him after he had cleared the bank. There was no wireless then to summon aid, and after the sea rovers had collected their loot they made their way, so the story goes, to Swan Island, where they buried it, celebrating their success by broaching many barrels of rum.



*A general view of the station buildings and towers*

At the northeast corner of the island the buccaneers erected a fort and in the waters off these breastworks they anchored their ships. Strangely enough, this is the weather side of the island and at first thought it seemed an error of judgment to choose it as a haven. Investigation shows, however, that there is a bight at this point in the coast, across which extends a reef. Behind this ridge of rocks there is an expanse of smooth water and in the reef was a gap large enough to permit the pirates' vessels to pass through. Conditions have changed since the sea rovers had possession of the island, however, and recent reports declared that there was hardly enough water to float a small fishing boat. In explanation for this geological transformation it is said that the waves on the weather shore have been piling up sand and debris which tended to make for shallow water, or that the island has risen considerably during the last 250 years.

Doubtless the men of the black flag looked upon the island as a veritable "find" when they came upon it. Here was an excellent anchorage for their ships and a comparatively safe retreat for their crews, all within easy distance of the treasure-laden galleons plying the Spanish Main. Moreover, the piratical craft needed overhauling from time to time and Swan Island afforded a quiet, secluded harbor in which to scrape the bottoms of the vessels free from barnacles and seaweeds without fear of a surprise attack from foes. It is likely, too, that the buccaneers were given an added feeling of security by the knowledge that as the ships lay tilted up on their sides the guns taken from their decks were planted behind the breastworks, ready to be fired at the first sign of a hostile sail.

Picture the amazement of Captain Swan and his men if they could visit Swan Island to-day. What would have been the measure of their astonishment as their vessels approached the land to sight the tall towers of the United Fruit Company's 50 k.w. wireless station.

The station, which was built in 1913 by the Marconi Wireless Telegraph Com-

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pany of America, is located about half way between New Orleans and Santa Marta, Colombia. It is an important link in the wireless service of the Caribbean and the communication between the United States and South and Central America. In fact, it was built primarily as a relay point for messages between New Orleans and Santa Marta.

Attached to the station are three operators who make their home in a one-story steel frame bungalow built of concrete and corrugated asbestos. A screened veranda with comfortable rocking chairs provides an attractive lounging place. Each operator has an individual room, supplemented with the comforts of the "States," including shower baths.

The wireless men look upon Swan Island as a desirable post, and only those who have shown that they are capable of performing excellent work are detailed to this Caribbean station. They receive six weeks' vacation every year and transportation to the United States —a feature of the detail which perhaps adds considerably to its popularity. In addition to their duties as operators they also act as deputy weather observers, making their reports to the United States Weather Bureau. For this work they receive extra remuneration, and because of these advantageous working conditions George S. Davis, general superintendent of the United Fruit Company's wireless service, receives many applications from operators in the employ of that company to be assigned to Swan Island.

S O S calls frequently reach the operators and the station has proved of considerable value in relaying the appeals and obtaining aid. The island is located in the paths of steamships voyaging through the Yucatan Channel en route to the Panama Canal, and consequently has more than ordinary interest to captains of vessels. A beacon light sends its rays far over the sea to guide mariners, flashing white four seconds at six-second intervals. It can be seen 23½ nautical miles from the average ship.

Outdoor life, of course, predominates on the island. For the operator who cares for bathing there is clear water and a sandy beach in front of the station. Motor boating is another diversion of the Swan Island men, one of their favorite pastimes consisting of short cruises in these craft about the waters adjacent to their home. When they tire of these forms of relaxation they can turn to shooting, for snipe, ducks and wild pigeons abound. Baseball and tennis are also included among the diversions. There are no snakes on the island, although iguanas are frequently seen. These creatures, however, as the Swan Islander comes to know, are inoffensive unless attacked.

In addition to the operators there are on the island a number of West Indians who are employed in gathering and making ready for shipment to market the 15,000 to 25,000 cocoanuts which are pro-

*This photograph conveys an excellent idea of the smooth beaches of the island*

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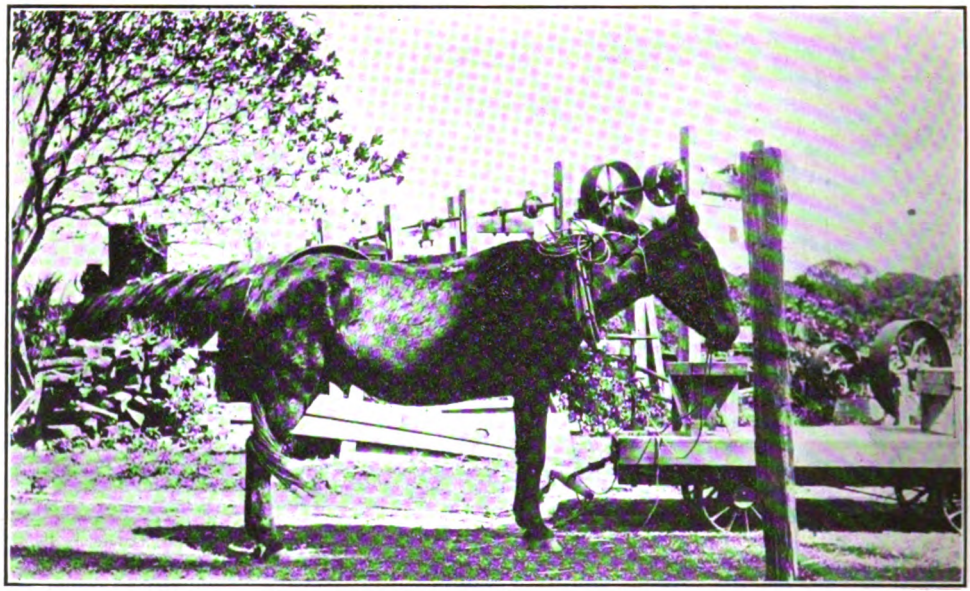
duced monthly. Visitors from Grand Cayman Island frequently land on the island and sometimes a sightseeing party from a yacht comes ashore.

The Caribbean in the vicinity of Swan Island swarms with interesting specimens of fish. On the southern side of the island is a small bay and on various occasions devil fish have appeared in this haven, coming at high speed from the open sea and swimming straight for the opening in the reef.

Some hair-raising stories of the deeds however, for old residents of the island to spin for the entertainment of the newly-arrived operators.

In the event that the operator is an angler he will find himself in a sort of Izak Walton land of opportunities, for there are at least half a dozen different species of fish to be caught within a mile or two of the island. Among them is the queen fish which is distinguished by its speed and agility. Barracudas, which provide highly exciting sport for the fishermen, swim in the waters by the



*Swan Island is nothing if not quaint. The motive-power of the railroad is here pictured*

of these dwellers of the ocean have been related. One of them is to the effect that when pearl divers are at the bottom of the ocean the fish hover over them so as to prevent them from rising, causing their death by drowning.

A habit of these creatures, according to Swan Island tradition, is the deliberate destruction of the cables of fishing boats when at anchor. So firm is the belief of some fishermen in this tale that they make it a rule to put two anchors over the sides of their craft. These stories, improbable as they perhaps seem, stick persistently in the minds of ignorant fishermen of the Caribbean, inducing them to look upon the devil-fish with infinite dread. They make excellent yarns,

dozen, and there are amberjacks, groupers and snappers as well.

Thick woods and open clearings abound, large numbers of birds being found in the exposed sections. Most of them are migratory, however, making their winter homes only on the island. Perhaps about ten of the species remain permanently. Among these are the baldpate pigeon, the Swan Island thrush, the larger frigate-bird, the cat bird and the black cuckoo. These, with their strange cries and call notes, accentuate the tropical atmosphere of the island in no small measure.

The pirates, as nearly as can be determined, were the first white men to inhabit the island, because there is apparently

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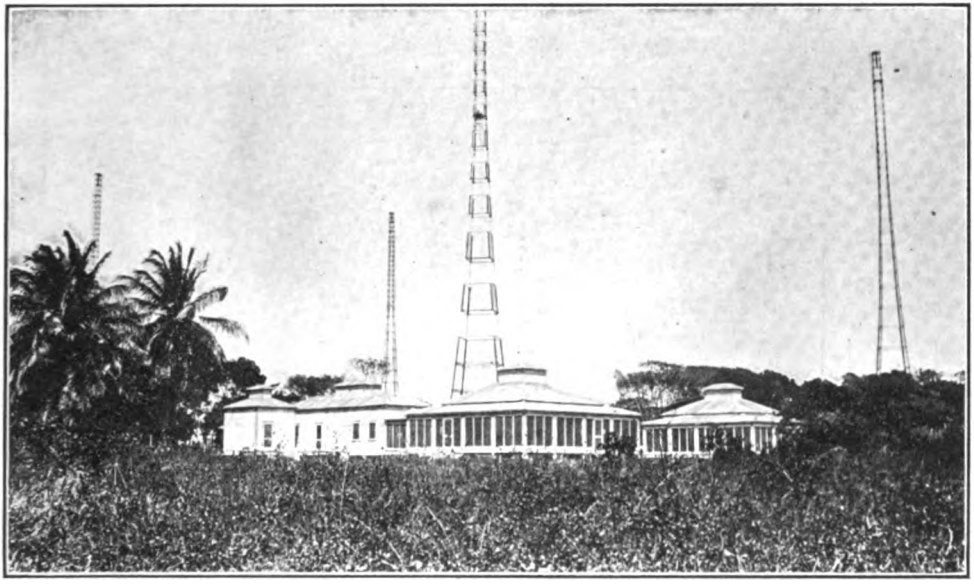
nothing to show that the Mosquito Indians who had their homes on the shore of the nearest mainland, ever visited the little tract. These Indians, history relates, were expert canoeists, but in order for them to reach the island, it would have been necessary to paddle and sail ninety-eight miles in the open sea—an undertaking calculated to make the hardiest hesitate.

South of this treasure ground of the buccaneers is Old Providence Island, which in 1664 was taken by a well-known buccaneer, Mansfeld by name, who probably had it in mind to use as a headquarters and anchorage for his fleet of fifteen vessels and 500 men. It is likely that Mansfeld's men were visitors to Swan Island and perhaps used it as an adjunct to their Old Providence station.

The interest centering about Swan Island is perhaps added to by the dearth of written narrative concerning the place. It is said that the first men identified with the history of the island since the buccaneers held sway there were two Englishmen, Alley and Page, who set out from Grand Cayman Island, where they lived, and landed on Swan Island. An account of their visit says that they felled enough trees to build a rough boat in which they returned to Grand Cayman Island. It does not appear, however, that they ever again visited Swan Island, although they called it their property.

Samuel Parsons, an ancestor of a resident of the Grand Cayman, was apparently the next self-appointed king of Swan Island. One of his first acts upon taking possession was to place on the island a considerable number of goats which multiplied rapidly, resulting in a few years in the formation of a large herd. However, the claim which Parsons established had little of permanence in it for, either misled as to the security of his rights, or careless in maintaining them, he found on one of his visits another claimant in possession.



*In the foreground of this photograph are shown the one-story steel bungalows in which the operators live*

This was Captain Alonzo Adams, an American sea captain. There are several stories regarding the manner in which he came to take possession of the island. One is that the captain was bound in his little schooner, the Polly Ann, for a South American port when Swan Island, uncharted and seemingly without good claim on the part of any one, loomed up invitingly over the horizon. The captain landed on the island and made a cursory examination. What he saw delighted him, but his business in hand did not per-

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mit him to remain long and he continued his voyage. When it had been concluded, however, he returned to Swan Island and took possession. There were about 100 natives on the island at that time and the place was quite primitive. Captain Adams changed living conditions somewhat in so far as he was concerned and erected a house in which he, his wife and his family, consisting of two sons and two daughters, dwelt. A lighthouse was also erected and in time Swan Island became an unofficial port of call for skippers, responding to Captain Adams' flag station signals. It was not unusual for passing craft to slow down and take aboard members of the Adams family or orders for supplies. To marine folk, however, the island became known principally as a port where cocoanuts in large quantities were taken aboard. Captain Adams abandoned his tropical home eventually to reside on a farm he purchased at Easthampton, Conn. His death, incongruous as it may seem after his life on the romantic little island, occurred amid conventional surroundings in a hospital in Boston.

So runs the story of Swan Island. A page from a Robert Louis Stevenson romance; a bit of coral in the ocean where poetic fancy can riot; a built-to-order place for a make-believe Robinson Crusoe. Such are the impressions gained by the visitor.

*A glimpse of the island as seen from one of the radio towers is shown in this picture*

*Swan Island on a calm day, picturing the waters as smooth as the proverbial mill pond*

Photo Courtesy Edison Storage Battery Co.

## OPERATOR WRITES OF SAN DOMINGO WAR EXPERIENCES

Simon Murphy, a wireless operator on the United States ship Memphis, which has been in the waters of San Domingo, has written to his mother, Mrs. Lucy Murphy, of 211 Second Street, Jeannette, Pa., telling of trouble with the Dominicans and the demolition of forts in Puerto Plata. The letter, which is dated on board the Memphis, at Monte Cristo, San Domingo, June 7, follows:

Here we are in Santo Domingo waters amidst great excitement, but I am in no danger, so don't worry. On June 1 we fired 25 four-inch shells, demolished two forts and took both trenches in Puerto Plata. Our marines were fighting 300 rebels ashore, and we were bombarding the town with the guns from the ship. One marine officer got killed by being shot by a rebel, but no others were injured. The battle lasted about two hours. It was exciting. We killed 35 rebels, and the rest left the city for the mountains and haven't been heard of since.

We handle all the radio for all the ships down here, and are kept busy.

## BULLARD NOW BATTLESHIP COMMANDER

Captain W. H. G. Bullard, superintendent of the naval radio service, has been assigned to command the battleship Arkansas, succeeding Captain W. R. Shoemaker, relieved for shore duty. Captain Bullard has been succeeded by Commander David W. Todd, recently in command of the second destroyer flotilla of the Atlantic fleet.

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# English Marconi Company's Earnings Large

## Annual Report Shows Gross Profit of Nearly Three Millions—Ten per cent. Dividends Declared for the Year With Possible Bonus in Sight for Shareholders

THE annual report for the year ending December 31, 1915, shows that the profit of Marconi's Wireless Telegraph Company, Ltd., amounted to $2,830,080.74. The net earnings for the year were $1,839,971.73, an increase of more than $725,000 over the profits of the preceding year. At the annual meeting, held in London on June 30, the Directors recommended a final 5 per cent. dividend on ordinary shares, bringing the year's total dividend up to 10 per cent. on ordinary shares; the regular 7 per cent. dividend was declared on preference shares.

Early press reports state that Godfrey Isaacs, presiding at the annual meeting said Marconi's invention to put an end to the danger of collision at sea in darkness or fog represented but part of his latest work. His new inventions would prove as epoch-making in the progress of the art of wireless as was in 1900 the now world-famous patent known as "the four sevens."

Since informing him that his research work in Italy as regarded the future practice of the entire science of wireless telegraphy and wireless telephony over both long and short distances would give results hitherto impossible. Marconi had visited England and described to him the nature of his new work. Mr. Isaacs expressed the hope it would be a long time before details of the inventions were made public.

"The longer it remains where it is," he added, "the better for us and the worse for Germany."

The report of the Directors does not include in the accounts any sum for remuneration and compensation from the British Government for use of the company's stations and services rendered since the beginning of the war. There are four heads under which the company will receive a remuneration from the Government, which has been rather slow in settlement, but which is expected at almost any time now. The Postoffice Department of England will be called on for the settlement in two instances: One for the use of the company's stations, and the other for the withdrawal of contracts which were made for the establishment of an Imperial chain of wireless stations. The War Department will also make a settlement with the company for the use of the company's patents during the present conflict. The same is true of the Admiralty.

It is intimated that a substantial bonus will be given to the shareholders when payment is received from the Government. Meanwhile the company is husbanding its resources and carrying forward to 1916 the sum of $1,497,750.13, together with $338,452.46 remaining from the 1914 profit and loss account. The general reserve account now stands at $4,711,871.22.

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It is reported in El Imparcial, one of the leading dailies of Madrid, that the minister of public works, after examination and report by the Centro Tecinco de Aeronauticos, has approved a radio signal receiver of a type that does away with the usual ear pieces.

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The lecture delivered at Columbia University on May 12, by Dr. John Stone Stone, as reported in the July issue of the WIRELESS AGE, was delivered under the auspices of the Radio Club of America.



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# Cruising Through Troubled Waters

## In Which the Unusual and the Thrilling, as Seen From the Decks of the Philadelphia, are Pictured

**By O. M. Shaw**

SHIPS are very much like human beings in some respects. One man for example, will go through life without even chasing his wind-propelled hat through a city street; on the other hand his neighbor's career may be crowded with exciting and unusual incidents. The history of the Philadelphia seems to be similar in a measure to that of the latter man—at least that was the impression I gained during the course of six voyages across the Atlantic I took on her as wireless operator.

I'll begin with an incident which occurred on September 4, while the Philadelphia was off the south coast of Ireland. My associate was in the dining saloon, and I was curbing with some impatience a ravenous appetite when a distress call came from the British steamship Hesperian (MSN), which said that she had just been torpedoed by a German submarine. Did you ever receive word directly from a sinking steamship with 500 persons on board, asking for aid? If you haven't it will be somewhat difficult for you to realize my sensations.

*Operator Shaw, who took six memorable voyages on the Philadelphia*

After the Hesperian's position had been taken it was found that she was sixty miles away from us. A British patrol boat (ZAAW), said that she was thirty-two miles from the wounded ship. The Philadelphia did not go to the aid of the Hesperian, however, because the patrol boat said that she was able to render all necessary assistance to the persons on the torpedoed craft. Later we learned that the Hesperian had remained afloat until the following day, but had gone to the bottom while being towed to Queenstown.

Christmas Day in the war zone brought forth the story via wireless of the running fight and final destruction of the British steamship Vansterum by two submarines. This is how it happened: At twenty minutes to two o'clock in the afternoon of Christmas Day the Vansterum flashed an S O S, saying that she was being chased by submarines twenty miles south of The Smalls and needed help at once. To quote from my log book: "Twenty-five minutes later the Vansterum still calling for help. Lands End wireless station (GCK), calling patrol boats to help Vansterum which now sends out: 'Help, please, quick!' Two minutes later, at 2.05 P. M., Vansterum says: 'Done for, position five miles south of The Smalls. Please pick us up.'" Then the operator on the Vansterum suddenly stopped sending. I learned later that the American steamship Georgiana (KJE) was steaming to the assistance of the distressed vessel, and that no loss of life resulted.

One of the unsolved mysteries of the sea came to my notice on March 4 while the Philadelphia was in mid-Atlantic. The weather was clear and the expanses



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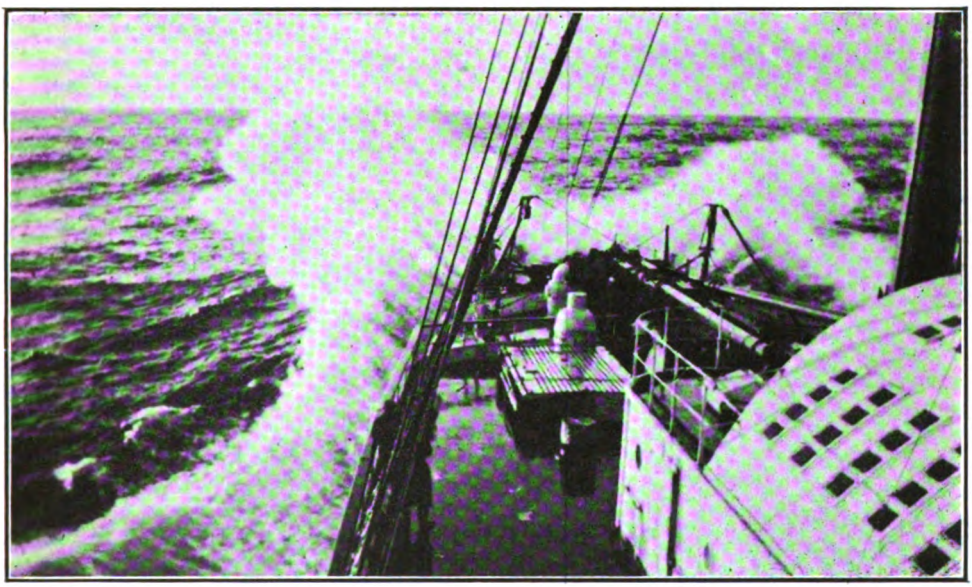
of the ocean lay before my eyes with not a blot to break the combination of blue sky, sparkling waters and bright sunshine. Suddenly, however, as if it issued from the depths of the ocean, a column of smoke formed in the distance. It was not like the black vapor that usually pours from the funnels of a steamship. Coal smoke is dark brown, but this seeming sooty exhalation was jet black. Then, too, the size of the column was too large to come from a steamship's funnels.

While I was watching this phenomenon the hull of a vessel came into view, stood out plainly before my eyes, and



*The Philadelphia plunging through after-storm swells*

disappeared as quickly as it had emerged. The smoke began to dwindle and in a few minutes it had also passed from sight. The Philadelphia pointed her nose toward the place where the smoke had been seen and arrived there about three-quarters of an hour afterward. But nothing was found to throw full light on what had been observed. Floating on the water were two empty lifeboats without anything to identify them and a small area of the surface of the sea was covered with oil. An odor of burning oil added to the mystery which shrouded the scene.

So the Philadelphia steamed away with her people in doubt regarding this tragedy of the ocean. For such it undoubtedly was, although what specific disaster the black smudge, the disappearing hull and the empty lifeboats told a story of, could not be determined. Even the wireless, which was employed to sweep the ocean far and wide with inquiries, could not break down the barrier surrounding the mysterious circumstances. Most of us on the Philadelphia, however, at length came to the conclusion that an oil tank steamship had been torpedoed and her cargo set ablaze by the explosion, the empty lifeboats being accounted for by the fact that the destroyed vessel's crew had met death in the flames while preparing to escape.

Somewhat different was the event which occurred on January 19 while a terrific gale was whipping the waters of the Atlantic into mountain-like waves. At the height of the storm the steamship Pollentia appealed by wireless for help. For many hours she had been buffeted by the seas until, with her engine room flooded, and the water pouring through her leaky sides, she flashed the S O S.

We of the Philadelphia could well understand the peril of the Pollentia—a little 3,000-ton tramp, waterlogged and broadside to the seas—for the big Philadelphia herself was being pounded se-

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verely by the waves. When the operator on the Pollentia was asked how long the vessel could keep afloat he tersely replied: "We can float until morning—if we don't roll over."

My narrative now brings me to the time when the Philadelphia herself figured in a collision at sea. We had left Liverpool on January 29 at five o'clock in the afternoon, and about five hours later, when off Carnarvon Bay light, came into collision with the sailing ship Ben Lee, bound from Liverpool to Australia. I was making ready to turn in when there was a terrific crashing and bumping, the racket beginning forward and making its way along the port side toward the stern. The ship quivered—just as if she had been shocked into a nervous tremor—and lurched heavily to starboard.

Hurrying on deck I found that the force of the collision had knocked one port lifeboat over the side and wrecked two others. The aftermast was broken off at the cross tree and had fallen on deck, the top having landed on another lifeboat which it demolished. Preparation were already being made to give aid to the Ben Lee's people. The mast having been broken, our aerial could not of course be used. A temporary aerial was rigged up, however, and we were able to communicate with Liverpool.

The Ben Lee and the Philadelphia in the meantime sent up rockets to summon aid to the former vessel, and she was towed into the harbor of Hollyhead where she sank in shallow water.

Although our ship did not fare as badly as the Ben Lee she was compelled to turn about and head for Liverpool, where she went into drydock for repairs. Then began some small events—paltry in themselves, but involving delay notwithstanding. The first occurred when, on leaving drydock, we came into collision with a small barge in the Mersey River. A three weeks' stay in Liverpool followed, but at length we prepared to steam for New York. When making her way out of the dock, however, the vessel was forced violently against the gates of the structure. Soon afterward occurred a strike among the firemen which resulted in a battle with fists in the forecastle. That night we remained in the Mersey; and in the morning we made another attempt to steam for New York, and this time we were successful.

It was quite appropriate, it seemed to me, that the last leg of the last of a series of eventful voyages should be marked by rough weather. How severely the seas dealt with the vessel may be determined by the fact that a wave struck us with enough force to break off five feet of the foremast mast at the top. Then, too, our voyage took eleven days instead of eight.

So runs the history of the Philadelphia as far as my experience on her went. It may not hold thrills without number, it may not be intensely interesting, but nevertheless it contains a true picture of an operator's life on an ocean steamship today.

## GETTING PRESS TO THE SANTA CRUZ ISLANDS

What is said to be the only wireless plant in existence operated to keep a motion picture company in communication with the mainland, is that on the Santa Cruz Islands in the Pacific, where a company is making a new photoplay.

Arrangements were made for a daily wireless news service during the stay of the company on the islands. There is no other means of communication except a launch, which makes the forty-mile trip to the mainland once a week.

## NEWPORT PLANT TO BE MOVED

The naval radio station at Newport, R. I., is to be moved, according to a newspaper report. It is at present located at the naval torpedo depot.

One of the chief reasons for the change of location is to place the plant on a higher point of land, thus increasing the range. At the same time it will be removing the apparatus from the zone of possible gun fire, and the torpedo quarters will gain additional land needed for building purposes.

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*Members of the Amateur Marconi Radio Association of Troy, N. Y.*

# With the Amateurs

THE final meeting of the season was held by the Wireless Association of Pennsylvania on July 14. It was announced by the secretary that the past year was one of the most successful in the history of the organization, and credit for the progress made was largely due to the excellent work of the technical committee and the interest displayed by members in its report. The recent work of this committee consisted mainly of the study of the vacuum valve detector and instruction for members in the requirements for securing a commercial operator's license. Plans for the coming year were formulated at the most recent meeting of the board of directors and special provisions in the program have been made for a large increase in membership; one of the inducements to be offered is the services of the technical committee to inspect and tune the apparatus of members and instruct them in the construction and use of the various parts of their sets.

It is claimed for the Wireless Association of Pennsylvania that the majority of the members possess sets of high efficiency and have several records for long distance work to their credit. Men of high standing in the field of radio activities are associated with this organization, as well as a large number of commercial operators, who leaven with experience the training of the main body of wide-awake amateurs.

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The wonders of wireless telegraphy were explained by amateur radio operators on June 23, to the members of the Engineers' and Architects' Club, of Louisville, Ky.

Members of the Louisville Radio Club, embracing all the amateur wireless operators in the city, were guests of the engineers and architects at a meeting



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held in their offices in the Starks Building.

C. C. Gall, a professional operator, made the point that wireless telegraphy was a great moral force. "The amateurs send their messages and perfect their work at night," he said, "and you can always find them at home when they ought to be there. Lots of men I know would be better men, and their wives would be happier, if they became amateur wireless operators."

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In the monster demonstration held in June in Washington, D. C., the preparedness parade featured the spirit of amateur workers who are making a concerted effort for adequate defense of the country. The amateur radio operators furnished one of the unusual features of the big procession.

In the lead was a twenty-foot truck, decorated with bunting, on which an aerial had been erected and an amateur wireless station installed. This was operated all along the line of march by F. N. Signor, W. A. Parks, who recently delivered an amateur radiogram to the president, and F. T. Reynolds, president of the Washington Suburban Club. There was eighty amateur operators in the parade, wearing their receivers on their heads instead of hats. This feature was in charge of and had been organized by F. N. Signor.

There are now over 250 amateur wireless telegraph stations in Iowa, according to Professor C. A. Wright, of the department of electrical engineering of Iowa State College, and practically all of these are now receiving the weather and news reports that are sent out twice daily from the big wireless station at Ames. Many of those receiving the messages have written to Professor Wright since the service was instituted, thanking him for it, and inquiring if it is to be continued through the summer. In some towns the reports are being posted daily in drug stores and places of business.

"It is our intention to continue our news service right on through the summer," is the answer Professor Wright has been giving. The service is to be improved as soon as feasible and blanks will be furnished to those who want them for bulletining the news sent out. The idea of adding several news items to the college news furnished is being considered favorably.

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Richard Burke, son of Rev. A. R. B. Burke, will erect a wireless station on the roof of the Chenango Street M. E. Church in Binghamton, N. Y. He has had a complete wireless set in Norwich with which he experimented successfully. He expects to carry on his experiments in Binghamton as soon as the apparatus has been placed.

*Class of girls at the National Service Schools studying wireless with the aid of a naval expert*

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Henry Geils is rapidly becoming known as one of the most active experimenters in the amateur ranks in New York City. Mr. Geils has offered the suggestion to the National Amateur Wireless Association that all its members convert their sets into portable field equipment, which in time of need could be turned over to the Government. To illustrate how this can be done, photographs have been forwarded of these converted sets made into field equipment by himself and his associates. In the illustrations reproduced, set No. 1 is that of G. Campbell, of Yonkers, an equipment which has been used in camp with considerable success. No. 2 is owned by F. G. Gregory, of New York, who conducted some interesting field work with it last summer at City Island. No. 3 is equipment owned by F. Bryant, of Westchester, and No. 4 is Mr. Geils's own set. In the illustration of the latter a small radio 'phone may be seen at the right hand; this, with a ½ inch coil and 10 volts, it is claimed can transmit eight miles. On the left hand lower corner is a ¼ inch spark coil; which, with an aerial 200 feet long, a series condenser to bring it down to 200 meters, and a 10 volt storage battery and quenched gap without helix connection, has worked more than 15 miles.

Mr. Geils and his associate, Mr. Shaffer, have been experimenting for seven years and claim to be among the first to take up amateur work in the New York district. They are now installing an outfit on board a boat and hope to be the first to float the N. A. W. A. pennant from the masthead. These enterprising experimenters also have in mind establishing a naval branch of the National Association, and will be glad to hear from those who would care to join them in this project.

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The Connecticut Valley Radio Society, of Springfield, Mass., gave the technical high school student body a demonstration of wireless telegraphy on June 23. Preceding the demonstration of the apparatus, James Booth, vice-president of the club, addressed the school on the theory of wireless telegraphy. He was followed by the president of the society, Glenn Sabine, who spoke on the practical side of wireless telegraphy, explaining in detail the various essentials for sending the receiving messages. A few lantern slides thrown on the screen by Clinton Denault illustrated the talk. Successful reception and transmission of messages followed.

While Principal Warner was thanking the society for its interest in the school and congratulating the large number of "Tech" boys who are in the club upon their ability, he was handed a postal card from the militia concentration camp at Framingham. It proved to be from three of the "Tech" boys who are in the militia. The postal, which was signed by Howard M. Hubbard, Kurt R. Sternberg, Jr., and Edwin D. Martin, was read by Mr. Warner to the school, being to the effect that they had all arrived safely and in all probability would leave for Mexico soon. The boys mentioned how proud they had felt on hearing their schoolmates cheering for them when they paraded to the station, and that they looked forward eagerly to the time when they would leave for Mexico, where they were going to do their best to honor "dear old 'Tech.'"

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Eight signatures are attached to the announcement that all persons interested in learning more about radio telegraphy and residing in or near Port Townsend, Wash., may open correspondence with Guy Hunter and be assured of a hearty reception from the enthusiastic amateurs who are on the lookout for recruits to their projected organization.

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Giving promise of becoming an institution of considerable influence and value among the amateur and professional operators of Kansas, the Wichita Wireless Association asks for recognition of the progressive spirit upon which it has been founded. Members best informed upon each subject take up the discussion of the topics which comprise a broad knowledge of the radio art and experts deliver addresses on aeronautic applications of wireless at the meetings on Tuesday nights; tests are also made on commercial instruments and experience of inestimable value is thus gained at first hand. Professor W. S. Ezell, of the Wichita Telegraph College, has placed the complete station of that

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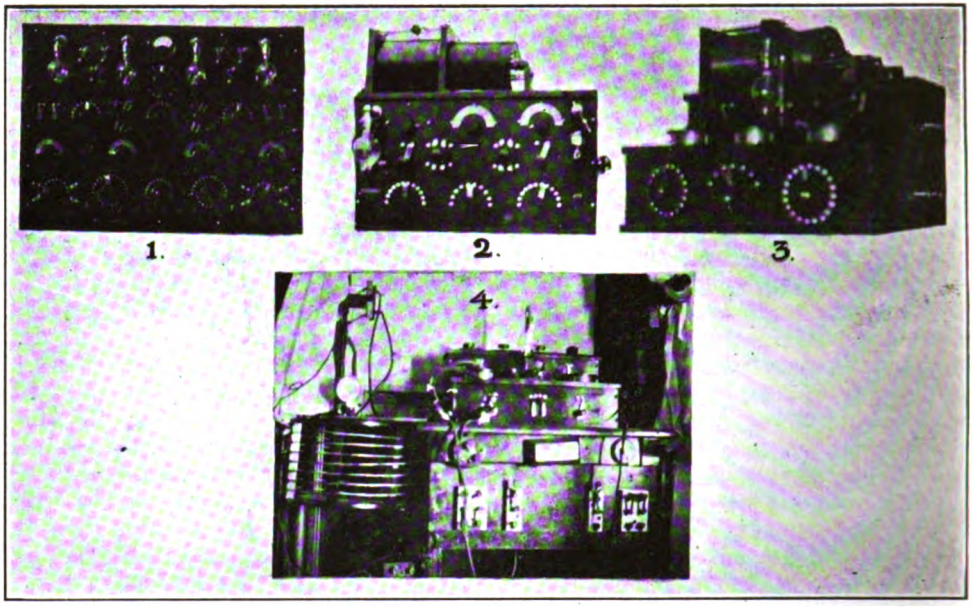


*Portable field sets made at the suggestion of Henry Geils*

institution at the service of the members. The college has an up-to-date laboratory and a long distance station which greatly facilitates instructional progress with those experimenters who have been hampered by the lack of suitable instruments to carry out their investigations. C. V. Williams is secretary and will give further information to those who write him at 525 North Emporia Avenue, Wichita, Kansas.

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A recent addition to the field of amateur organization is the Miami Wireless Association, of Miami, Fla., which was organized on April 19 with fourteen members. Howard Henshaw is secretary and may be addressed at R. F. D. No. 1, Miami, Fla.

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The Radio Club of Irvington, which was mentioned in the June issue, has its headquarters in the State of New Jersey, not Irvington, N. Y., as the article erroneously stated.

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The Amateur Marconi Radio Association, with headquarters at No. 1627 Seventh avenue, Troy, N. Y., has announced that it will hold one meeting each month during the summer and will continue programs as interesting as those which have characterized its past season's work.

At the first of the June meetings its members were addressed by Roland B. Bourne, of the Rensselaer Polytechnic Institute, a former employee of the American Marconi Company, who spoke interestingly on the "Goldschmidt Alternator Frequency-changer Method of Transmission," as employed at Tuckerton. Mr. Bourne, who is an honorary member, provided a very interesting discourse for the members in offices of the Schenectady and Albany radio associations, who were present. Plans were discussed for tri-city conferences.

At the second meeting, it was decided to erect at the Y. M. C. A. club headquarters a more powerful station; this will probably be done in the Fall. The semi-annual election of officers resulted in the choice of William A. LeMay, former vice-president, to succeed Wendell W. King, who has served efficiently as president for three terms. Mr. King is soon to enter Union College for an electrical engineering course. E. Malcolm Williams was elected secretary-treasurer, following which he spoke to the members on the "Elementary Mathematics of Aerial Construction."

William E. Robbins, a former member

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of the Amateur Marconi Radio Association, has left for the Mexican border with the National Guard.

*Miss Kathleen Parkin, who is described as one of the youngest girl wireless operators in the world*

Miss Kathleen Parkin, of San Rafael, Cal., recently received a first grade commercial license. Miss Parkin is fifteen years old and gained her knowledge of the art of radio communication in her brother's station, where, as she expresses it, "I spent every minute of my spare time, and often helped him to make his instruments." She has made, without assistance, a ¼ k.w. outfit and now proposes to make a rotary spark gap and vacuum valve detectors for the receiving set with which she now uses a galena detector successfully at distances up to 1,000 miles.

Miss Parkin is beginning her third year of high school at the Dominican College, San Rafael, where there has been installed a small wireless set for the instruction of the physics class. Amateurs within range will be interested to know that Miss Parkin's call is 6-SO.

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Under the leadership of O. M. Howard, the amateurs of Fresno, Cal., recently organized a radio club which promises to be one of the most successful organizations in that locality. Widespread publicity was given in the local papers and it is reported in Fresno and other parts of the San Joaquin Valley that since then there are a large number of men and boys who are taking great interest in wireless telegraphy. They have erected aerials and provided instruments, but so far have been working at cross purposes with few people to talk to and no organization to further the work, so there is a definite need for a progressive club of experimenters. Mr. Howard has planned the construction at his home of a 200 meter set, with a maximum range of 100 miles for transmitting, and will add to it a 3,000-mile long-distance receiving set. Recognition of the project was given in the local newspapers to this effect:

"In organizing the radio club, Fresno becomes a center of activity for the San Joaquin Valley. In order to have the club organized, application will be immediately made to the National Amateur Wireless Association, of New York City. This is the governing body for amateur wireless and all clubs operate as auxiliaries. One of the principal objects of the club will be to teach its members the use of the Continental Code, and Mr. Howard hopes to interest the Young Men's Christian Association in the new club and in this way get a large number of boys to participate. The temporary organization which was effected at the first meeting placed R. V. Denny as chairman, and O. M. Howard as secretary and treasurer. Oscar Schuwendt, Arthur Foster and S. M. Smith were appointed a committee to draw up the constitution and by-laws. Seventeen members were enrolled at the first meeting.

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The second anniversary of the Bellevue Radio Chain, a club composed of the amateurs of the north boroughs of Pittsburgh, was celebrated with a banquet in its club rooms, located on Lincoln Avenue, Bellevue, Pa. The last election provided the club with the following officers: C. Kraus, president; T. Wray, secretary; W. H. Hoobler, treasurer.

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Discontinuing regular meetings for the

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summer months, the New London Radio Club, of New London, Conn., wound up the season with a banquet on June 2, served at the local Y. M. C. A., with twenty-two members gathered about the board. The principal speaker of the evening was Captain Stockford, of Fort Wright, who selected as his subject "Wireless During Wartime." Captain Stockford commended highly the work of the members and said it was considered of value both by himself and the Government, which was interested in them and ready to help at every opportunity.

The six honorary members were then called upon for two minute talks and the banquet was ended with a reading of a brief history of the club.

A committee was appointed to arrange for a course of instruction during the summer months, to be given by a navy operator free of cost to all members.

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Bayonne, N. J., now has a club organized by the amateurs of the Bayonne High School. This organization has announced that it will become affiliated with the National Amateur Wireless Association and already has several members who are enrolled in the parent organization. Ernest Ruhlmann is president, and Peter Klimas is secretary and treasurer.

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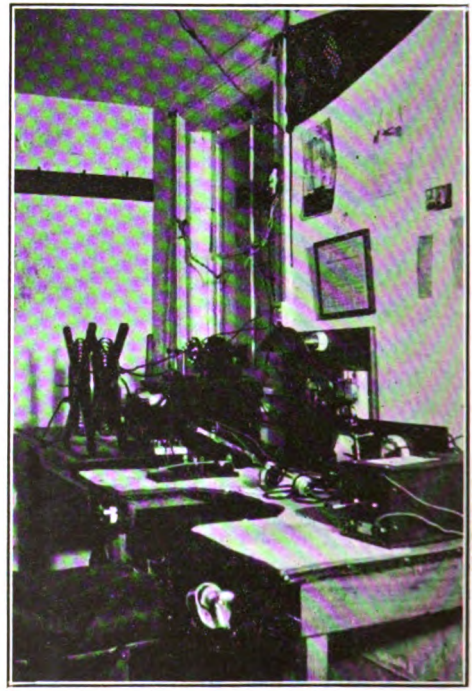
Sixteen charter members signed the constitution when the Santa Cruz Radio Association of Santa Cruz, Cal., was recently organized. Six new members have since been taken in and a large enrollment is shortly expected by the officers. The club rooms of this organization are located in the center of the city and consist of a library, open at all times to the club members, a meeting room, in which the members meet once a week, a reception room and a well equipped operating room. The transmitting apparatus is of 1 k. w. power, having an oscillation transformer and a rotary spark gap. The receiving set is a loose-coupled cabinet equpiment. Two aerials have been erected, one for receiving, 600 feet long, and a 6-strand, 50-foot antenna for sending. The address of this club is 203 North Brancifort Avenue, Santa Cruz, Cal.

Residents of Denver have reason to be proud of the progress made by the Colorado Wireless Association which is making rapid strides under the guidance of Homer O. Whitman, president. The club headquarters is exceptionally well equipped, having two complete rotary quenched sets of 1 k. w. capacity each for sending, and receiving apparatus provided with vacuum valves, a 2-step amplifier and tuning inductances for the reception of damped and undamped waves up to 20,000 meters. The record working distance is given as 1,500 miles, with the steamship Columbian, en route to Chili. Hanover and Nauen in Germany have been received in daylight, as well as Darien, Tuckerton and Arlington, across the continent.

Mr. Whitman is authority for the statement that signals from Sayville and Tuckerton and the time signals from Arlington can be heard from 30 to 50



*An efficient set, the property of Henry A. Wheat, of Geneva, N. Y.*

feet from the receivers. The greater part of the apparatus is home made and in consequence the members feel very proud of the station, particular satisfaction being displayed with the rotary quenched

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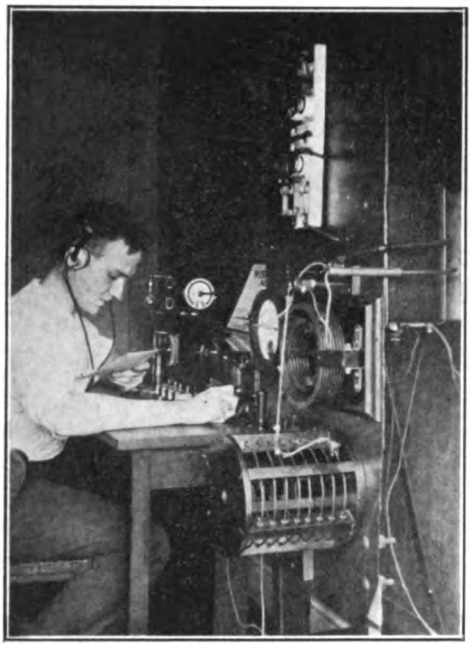
gap and valve receiving cabinets, which were made entirely by members.

When the Fowler Radio Club was recently organized in Cleveland, O., the ten members participating in the organization reported that they were all members of the National Amateur Wireless Association. Charles H. Bell was elected president and Frederick R. Franklin, secretary and treasurer.

Thirty-five members have been enrolled in the Albany Wireless Club, Albany, N. Y., with headquarters in that city's Y. M. C. A.



*Ralph R. Chappell and his set*

Ralph Raymond Chappell, of Richmond, Va., is the owner and operator of station 38-T of the N. A. W. A. A photograph of the set and its owner appears on this page. As only standard receiving apparatus is used the details need not be given. One object of interest, however, is the hot wire ammeter, built in an old steam gauge case. The volt meter is also home made.

## An Amendment to Radio Regulations

The United States Bureau of Navigation has announced that the following regulation which is made pursuant to the Act of August 13, 1912, should follow Paragraph 152, Page 66, of the Radio Laws and Regulations of the United States:

Paragraph, 152-a, Page 66.

Holders of commercial extra first-grade radio operators' licenses may be issued renewal of such licenses without examination, provided the service records on the backs of the licenses properly certify to twelve months' satisfactory service in a land or ship station open to general public service, at least six months of which must have been served during the last twelve months of the license period.

However, holders of commercial extra first-grade licenses now employed as radio inspectors, radio instructors, or in similar occupations requiring exceptional qualifications where the duties require the testing, or demonstrating, or otherwise using commercial radio apparatus and the telegraph codes, may be issued renewals of their licenses without re-examination, provided, in addition to the above, they can show satisfactory evidence of such service covering a period of eighteen months out of the two-year license period. Where the applicant has not used regularly the telegraph codes, he will be given the code examination required in the original examination or, if he has used only one code, he will be examined in the code not used.

The service record shown on the licenses must be transcribed on Form 756.

The license may be marked "Expired" in red across the face and returned to the operator, if desired. The action taken should be noted on Form 756.

Where the record on the reverse side of the license does not show the service performed, the evidence submitted as proof of such service must be transmitted to the United States Bureau with Form 756.

Transcriptions of code tests must be submitted to the Bureau.

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*"Nowadays," the young man in the gorgeous blue uniform told the girl, "the Captain is a small potato compared to the wireless man"*



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# Brass Buttons

**By Magda Leigh**

*Copyr. Seven Seas Co.*

SHE lay alongside her dock, straining against the taut hawsers that held her, fore and aft. There was a busy swishing of skirts and a tramping of feet, up and down her amidships gangway. Over her yawning hatches, big nets full of cargo hung suspended, to be lowered, with a sudden run of the panting steam-winches, into the large holds. The last of the car floats nudged against the black hull, and an angry stevedore shouted his uncomplimentary opinion down from the after-well-deck at the belated arrival.

Captain Kerby stood on the bridge, pacing back and forth, looking down upon the scene below. The Little Third, clambering up the iron ladder from number two hold, raised a finger to his cap and shouted:

"Number One is finished, sir. Number Two will be, in about five minutes more." Captain Kerby smiled down at him and rumbled: "Good!"

The Tobago would be late getting away. She was invariably late. In fact, had any one asked her officers what they thought of their ship, the answer would have been unprintable. She was spoken of, by them, as "that big brute, the Tobago." She was unwieldy, tricky, unlovely. But her holds were capacious and her boilers good. Given plenty of space for cargo, and the wherewithal to drive that cargo between New York and West Indian ports, and what more could a company desire?

The Chief Officer, Mr. Taggart, tall, bronzed and muscular, approached the Captain and held a moment's conversation. He was followed by the Chief Steward. Then the Chief Engineer. From all departments—and the dock—men reported to or asked questions of the "Old Man."

And he was old—Captain Kerby. Old in knowledge, in experience, in faithfulness. Since young manhood, he had followed the sea, promotion coming to him rapidly, owing to his capable seamanship and his unfailing diligence. He had held better berths than the command of the Tobago, but none where he had made more money. This meant much. When a seafaring man grows too old to go to sea there is only one decent thing for him to do: provide handsomely for his family—if he have one—and die. This Captain Kerby realized. His efforts were all toward leaving Mrs. Kerby and the two lovely daughters comfortable.

He had never had any serious accident since taking command of his first ship. Never. In all his years as skipper, a kindly Fate seemed to have stood beside him, and he had brought his ships through snow, ice, lightning, fog or hurricane, without disaster. An enviable record, extending over a score of years. But there was always that dread possibility of an accident, now that he was so far clear. One never could tell! One huge engulfing sea—a submerged derelict—some other fellow's reckless speed in a fog—one never could tell!

These thoughts, accompanied by kaleidoscopic memories of faces of other-time shipmates, flashed through Captain Kerby's mind as he strode to and fro. His eyes raised now to the Blue Peter, fluttering aloft, now lowered to the British flag at the taffrail.

He paused a moment and shook his head. One never could tell—not with the German cruiser Niedheim hovering over the fringes of the Indies, destroying British commerce!

Suddenly there was a cessation of noise—a ponderous, startling quiet, punctuated by dull thuds. The Old Man roused himself. Those thuds meant the


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lowering into place of the after-cargo booms. Number Three was at last finished.

The Little Third came slowly up the bridge ladder. His shabby uniform, much the worse for wear, was brushed of all removable dirt. His face shone from a violent application of soap and water.

"All finished, aft, sir, even to that lighter of cornmeal and flour."

The Mate was standing by, forward, on the fo'c'sle-head, waiting to oversee the casting off of the lines which held the Tobago's high bow shoreward. On the poop-deck, the Second—a strapping handsome Nova Scotian—stood by the afterlines.

The gangway was in; the lines were cast off. Two important, puffing tugs yanked and pulled and dragged at the back hull, and the Tobago moved slowly astern into the stream. There she was nudged and buffeted and shoved until her nose pointed down Buttermilk Channel.

The Little Third, at a word from the pilot, gave the engine room telegraph a yank. There was a faint jangle of bells, way below; an answering jangle on the bridge; a rumble, a shudder, and the Tobago, to the slow rhythmical beat of her own engines, set off on her way to Trinidad, B. W. I.

The Old Man sighed heavily. It was a hard life. Here was the old Tobago, under British registry, putting out to sea—and the Niedheim looking for prizes, somewhere to the south'ard. There was a new bo's'n this trip, who looked as if he would like to murder every negro in the crew, and a new stewardess, who was far too young to let loose aboard a ship full of men. There was a new Junior wireless man, too. He was the son of one of the stockholders in the company. He came to the Tobago with wonderful recommendations.

The Skipper said something, softly, under his breath, as he remembered about the Junior wireless man. "A gentleman's son! A special-German-prize-high-school graduate! A *nice* boy!" Oh, Lord! to give a man *that* kind in his crew—and in war times!

"He'll be full of big ideals!" the Old Man grumbled to himself. "One of those fussy young dandies who had a clothesline wireless set on his mother's roof—who smokes tailored cigarettes—and whose ambition is to be an S O S hero! I know the kind. They seem to think their one duty in life is to look magnificent in their new brass buttons, to talk modestly of their unflinching courage in times of danger, and to use some sort of preparation that makes their hair set straight back from their foreheads—like the pictures of the Apollos in the clothing ads!"

In spite of the activities of the Niedheim, the Indian Line was still running its ships under the British flag. There was a multitude of reasons for this—reasons which had their origin in the head offices of the company in Scotland.

In spite of their efforts to keep it quiet, there was a rumor along the waterfront that the cases marked on the manifest as containing "telephone batteries," and the kegs marked as containing "galvanized nails," held other matter. Some of the British cruisers in West Indian waters were in need of a slight replenishing of ammunition, and the old Tobago, lumbering on her seemingly innocent way southward, was more or less an arsenal.

Immaculate uniforms were an unknown quantity on the Tobago. The officers' pay was not high enough to allow much dressing. Therefore, it was with rather a shock that the Old Man ran full tilt into a gorgeously new uniform, after dinner, the first night out. Within the spotless garb was a slender form, vibrant with youth and tingling with pride. The Junior wireless man was in earnest conversation with a pretty young girl who had not yet succumbed to the effects of the Tobago's slow roll. The Old Man sauntered near, to feast his eyes on the wonderful spectacle.

It is a fact that Captain Kerby had no intention of listening to the conversation, but the words of the new addition to his crew floated serenely across the space between himself and the absorbed couple.

"Oh"—deprecatingly, "the Skipper does not have much to do or say any more. In the old days of sailing ships, and before there was wireless, he was

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the Big Thing—the Main Squeeze. But now! Why, look at the part the Skippers have played in recent disasters. Look at the part the wireless men have played! Why, when the Titanic struck that iceberg, the Old Man was at supper. It was the wireless man who called those other ships to the aid of the drowning people, and the wireless men of the other ships who answered that appeal. In the disaster to the Monroe, it was that young fellow, Kuehn, whose picture was on the front page, as the hero. Of course, I do not mean that the Captain has nothing to do, in a wreck," generously. "But, nowadays, he is a small potato compared to the wireless man!"

Captain Kerby fled. Fled precipitately to his big, airy room, where he could give vent to his feelings in privacy—and in all completeness.

Wasted, all his years of service! Wasted, all his wonderful seamanship that had dragged the battered Bayamon through the hurricane of '96, and the disabled Managus through a night of hell off Hatteras, a few years later! Wasted were all those years of tireless watching and serving through storm and stress! He was deposed—supplanted—eclipsed—by this beardless youngster with the new, shiny brass buttons! The colossal young braggart! The insufferable little lubber!

For two days, the Tobago rolled her slow way southward, without anything more than a beam sea to disturb her tranquillity. But in those two days things were shaping themselves into a seriocomedy aboard the Tobago. The Skipper had, in a moment of thoughtlessness, spoken of the new Junior to the Little Third, as "Brass Buttons." The name spread like a disease—like a plague—over all the ship. From the chartroom to the stoke-hole, young Charlie Brown was known as "Brass Buttons."

The Senior wireless man was an experienced operator. He knew his duties from A to Z and attended to them quietly and unobtrusively. Perhaps, somewhere in his mind, there was a vague wish that he might be a "hero" some day, but just now, his main thought was to hammer some sense into his Junior—"Brass Buttons." True, the latter was a classy operator—could send and receive like a streak. But, oh! What he didn't know about ships and seagoing wireless matter! And it looked as if he would never learn. His log was a joke; his watch another. He had been warned, time and again, not to send any messages, after leaving a certain latitude, owing to the active Niedheim. But he had "butted in," during one of his watches, when he heard a fruit boat asking the air in general, if anything new had occurred in the zone of war. Brass Buttons had obligingly given the Fruiter the latest news from New York. This was, of course, the height of consideration for the Fruiter. But, unfortunately, a vigilant operator on the Neidheim happened to be listening in. Brass Buttons had told the fruit boat the name of his ship, and had pleasantly informed him of the rumor concerning the Tobago's cargo. All of this was duly reported by the Niedheim's operator to his commanding officer.

Now, the commanding officer, being a perfectly good German, could imagine nothing better than capturing the Tobago's kegs and cases. Their contents would serve a German criuser quite as well as a British cruiser. Therefore, although there were many finer British ships afloat, many more desirable prizes after which the German might have raced, she hovered about in a certain vicinity, and waited.

Somewhere about 17.55 north and 63.12 west, Brass Buttons overheard, during an afternoon watch, a near-by, strange spark, talking via wireless. Enthusiast that he was, he scribbled down the dots and dashes as they came into his receivers. At first they made no sense. Then suddenly, Brass Buttons realized that he was taking down German. This was fun! His pencil raced across the form in front of him and a superior smile flashed into the brown eyes. Humph! Even Nobbie, the Senior, knew no German! Nor did the rocky, little, old sarcastic Skipper! Well, he'd show them! Call him "Brass Buttons," would they? And lord it over him? Well, he knew things they couldn't know, not in their lifetime, by Jove!

The words he was copying began to form themselves into definite, pregnant

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sentences. They had to do with the Tobago—she was being reported to the Niedheim—two days ago in latitude 25.58 north, longitude 66.46 west. Steering about south 21 east—black hull—red funnel—high amidships and well-decks, fore and aft.—An awkward ship.

There was more, on the same order. Brass Buttons was thrilled. Some ship which had sighted the Tobago was giving her whereabouts to the German, eh? His British blood leaped. This was great! This was life!

He wondered what the Old Man and Nobbie would say when he chose to tell them what he knew? Brass Buttons considered that he *might* tell the Old Man—tell him in a sort of condescending way, as if picking up German from the air were child's play to him, although it was Greek to the Old Man!

But first—oh, madness of Youth! Brass Buttons decided he'd have a little fun with the "Dutchmen." He'd give 'em, a chase, all right! He fussed around with his apparatus a bit. Then, throwing on the power, he sent, in fluent German:

"Steamer reported must have changed her course. Sighted her yesterday, sailing almost due east. Was evidently making for Barbadoes."

There was a brief pause. Then there flashed back an abrupt: "Who are you?"

Brass Buttons grinned. He'd show them! He hadn't had a wireless outfit on his mother's roof for nothing—not he. He knew the call-letters of half the ships that sailed the seas. In steady, impertinent dots and dashes, he flashed back the call letters of a well-known German ship which ran between New York and South American ports.

There is a Fate that surely watches over fools. Brass Buttons, absorbed in having fun with the Dutchmen, sent convincing answers to every one of the questions hurled at him by the German ship which had been giving the cruiser information. The cruiser, silent throughout the entire conversation, nevertheless took the words of both talking ships. Oh, fortunate youth who had won a special prize in German! His sending was superb! His fluency, faultless!

He was sure, judging by the thanks he received from the German, that he had impressed the enemy with the fact that the Tobago was making for Barbadoes. The Niedheim was silent, of course, but it was policy for her to be so. Brass Buttons had had some *fun!*

When Nobbie came to relieve him, he found the Junior operator leaning back in his chair, arms behind his head, a dreamy, contemplative smile on his unshaven lips. The form pad, with meaningless, silly scribbling on it, lay on the table before him.

"Anything new?" Nobbie grunted. He had been sleeping rather soundly, below, or he might have known there was indeed "something new."

"Nothing of any importance," Brass Buttons yawned. "A Dutchman was sending a while ago, I butted in, though——"

"You *what?*"

There was superlative horror in Nobbie's tone.

"Butted in," Brass Buttons repeated.

Nobbie sank down on the settee and stared, in agony, at his Junior. "You ass! You—oh, Lordy! You ass!"

For a moment, Brass Buttons was inclined to say things. He had been called about enough names. Nobbie, however, did not give him a chance. He reached for the telephone communicating with the chart room and rang the bell.

"Mr. Taggart, is the Skipper about?"

It was the Mate's watch and the answer was immediate.

"Yes, very important.—Oh, I say, we'll come to him—oh, all right, if he prefers!"

He hung up the receiver and turned on the Junior. 'Now, you bally idiot, you tell that to the Skipper. I'm through with you!"

Brass Buttons did not reply. He moved, so Nobbie could take his place before the set, and going to the small mirror he had installed in a corner, smoothed his hair back from his forehead. He was thus occupied when Captain Kerby entered.

"Well, what's the matter?" the Skipper asked, gruffly. "What's wrong now?"

Nobbie tried to speak, but failing, pointed mutely to the Junior.

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Brass Buttons faced his Skipper, calmly. "Nobbie's all excited because I told him I butted in on a Dutchman, a while ago."

"You what?"

"I butted in on a fresh Dutchman," he repeated, testily.

"I suppose you mean—" Captain Kerby's tone was verbal steel, "I suppose you mean that you have been talking to a German, when you have orders not to send at all?"

Brass Buttons' answer was wholly cheerful. "Yes, sir. But—"

Captain Kerby sank down on the settee and covered his eyes with his hand, as if to shut out the sight of this overwhelming young idiot.

"There is no such word as 'but,' at sea, young man. When you're given an order, you're supposed to obey it. Now tell the whole damning story, from beginning to end. Who and what was the 'Dutchman,' and what was he saying to you?"

"He wasn't talking to me, when I butted in," Brass Buttons replied, sullenly. "He was sending our position to some other German ship—that cruiser, I imagine. He described us, and gave what was our position, day before yesterday."

The Skipper groaned. "And you butted in and told him where we were to-day, I suppose?"

A sudden thought caused the Old Man to look sharply up at the Junior. "How do you know he was a German?"

"He was talking in German," doggedly.

"He was? Then how did you know what he said?"

"I speak German fluently," Brass Buttons announced modestly.

The Old Man seemed to be struggling for breath. "Oh, you do?"

"Yes, sir. I took a special prize in school for German."

There was a pause. Then: "Have you a copy of what passed between you and this—'Dutchman'?"

Brass Buttons reached over to the table and gathered up the form pad. He handed it to the Captain. Be it known, there was a look of malicious triumph in the eyes of the Junior operator.

The Old Man gave the papers one glance and then shoved them back at the youth. "Read them to me. I didn't win any prizes at school!" he thundered.

And Brass Buttons translated, fluently. As he talked, the Skipper's body lifted itself slowly from the settee. Brass Buttons did not notice the peculiar movement, nor did he see the extraordinary expression which sifted over the Skipper's face. He finished it and looked calmly at his superior.

"That's all. I bet that Dutch cruiser is chasing as hard as she can go toward Barbados, trying to intercept us!"

The Skipper gasped. "'Out of the mouths of babes and sucklings,'" he breathed, inaudibly. He stood silent a moment, thinking intently. Then he advanced a step nearer the Junior and shook a finger under his nose.

"Now, listen, young man! And listen well! For what you've done today, I ought to stick you down in the lazarette with the rats! You've disobeyed orders—and in war time! Oh —" He broke off, despairingly. "What's the use?" He turned to Nobbie. "Keep this—this—young fool out of this wireless room, until I can spare an officer to watch over him when he's on duty."

Brass Buttons turned and walked majestically out of the wireless room. This was the limit. He had been called an ass, an idiot, a fool—everything under the sun that he felt he was not.

Captain Kerby gave Nobbie some orders. Then he made his way hastily to the bridge. Here, he told the Mate of what had happened.

"The German may have swallowed it, and again, he may not. We've got to get to Trinidad, that's all—and pronto! We'll have to sail without lights at night —and I've an idea it may pay to change the color of our funnel, Mr. Taggart."

For the next two days the Tobago made her way stealthily toward her goal. Her funnel had changed from

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bright red to black. She looked, for all the world, like a respectable tramp. At night she ran without lights, much to the consternation of the few women passengers.

When the Tobago crept into the Gulf of Paria, one of the most difficult feats of navigation ever heard of in these waters had been performed. Captain Kerby had brought his ship in through one of the lesser Bocas in a fog and a heavy sea. It had been a terrific risk, but—there was that highly important cargo to be delivered. He had chosen one of the smaller Bocas, because he had a suspicion the German might be hovering around in the vicinity of the Boca Grande. One never could tell.

An official of the Indian Line was one of the first up the accommodation ladder. In his hand he waved a slip of yellow paper. He was visibly excited.

Captain Kerby met him on the saloon deck.

"Great news, Captain!" the official hailed. "The German cruiser Neidheim has been sunk by the British!"

For an instant the Old Man stared. He had a sudden, queer premonition. He grasped the rail as if to steady himself, and asked: "Any details?"

"Plenty!" the official beamed. "She was sunk off Barbados, night before last. Jove! she ran right into our ships. We got the news by cable."

"Off Barbados?" The Skipper's voice was weak.

"Yes. Must have been chasing something over there. Our people got her right in their arms!"

The Tobago was back in New York. There was silence aboard. The Old Man had gone home to his wife and two lovely daughters. Nobody remained aboard but the Senior wireless man and the Little Third. They were sitting gloomily in the latter's room below.

Burst in upon this scene of quiet and loneliness, none other than Brass Buttons, he that had been ignominiously sacked immediately upon arrival. In his hand he held a copy of an evening paper.

"Hello, Nobbie! Hello, Mac! Have you seen the evening papers?" he burst forth.

The Senior frowned. "No—why?"

The answer was the tending of the paper to him. On the front page was a large picture under the big, red headlines. The picture was unmistakable. It was Brass Buttons! Nobbie leaned forward under the light and stared. It was Brass Buttons in his beautiful new uniform.

"Wh—what—is it?"

"Read!" The command was majestic.

And Nobbie read.

In his dining-room, under the drop light, with his wife and two lovely daughters hanging over his shoulders, Captain Kerby was reading the same thing, in other papers.

It was great copy—one of those "Hero-of-the-deep" things. It told, in high headlines and lurid language, how one Charles Brown, son of C. G Brown, operator on the steamship Tobago of the Indian Line, had, by a clever ruse, sent the German cruiser Neidheim full tilt into the path of two British scout cruisers which were patrolling the high seas in search of her. It told the whole story of how young Brown, "one of the most modest of wireless heroes," had picked up the report of a German ship, had butted in, cleverly, and in fluent German, had put the enemy off the scent of the ammunition-laden Tobago, and sent her chasing a phantom, right into the very guns of the waiting British. It even told how Charles had won a special prize for German in High School.

Nowhere in the whole article was Captain Kerby mentioned, except as the veteran Skipper, who was fortunate to have this brave lad on his ship.

And all at once, Captain Kerby remembered the words he had heard the second day out on that eventful trip: "Nowadays the Skipper is small potatoes, compared to the wireless man!"

And as he leaped to his feet, gurgling hysterically, his wife and two lovely daughters wondered what Captain Kerby meant when he sputtered:

"'Out of the mouths of babes and sucklings'—Brass Buttons! Oh, Lord! Brass Buttons!"

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# How the Bear's People Were Saved

## What Wireless and Wireless Operators Did When the Vessel Was Wrecked in the Fog Bound Waters off Cape Mendocino, Cal.

ANOTHER steamship disaster in which wireless was employed as a means of saving lives has been reported from the reef infested waters off Cape Mendocino, Cal. While southbound from the Columbia River to San Francisco the steamship Bear went ashore at a point which lies approximately at middle distance between False Cape and Sugar Loaf Rock. The wrecking of the vessel, which was eventually lost, was due to the necessity of a change of course in a strong set of the current and the hampering presence of a heavy fog.

The prompt use of the wireless service by the two Marconi operators on board—L. S. Grabow and his assistant, J. F. Woods—who flashed the S O S three minutes after the ship struck, resulted in relief being despatched in record time to the persons on the Bear, and the saving, according to estimate, of 205 out of 210 lives. The discipline of the captain was equalled by the fortitude of passengers, who were safely launched in the small boats.

The stranding of the Bear occurred at twenty-two minutes after ten o'clock on the night of June 14, and the passengers and crew were made immediately aware of the fact that the steamship was in trouble by the jar as she struck the rock and stopped, careening, while the shrieks of the whistle and the booming of the surf nearby informed them of the nature of the happening.

Woods, the second operator, has given a vivid account of the subsequent happenings on board. Both of the Marconi men were in the radio room at the time. Grabow, standing by the wireless instruments, instructed Woods to repair to the bridge and ask the captain for instructions.

*J. F. Woods, second operator on the wrecked Bear*

"The distress signal was sent out three minutes later," said Woods. "The Marconi operator at the Eureka station answered instantly, and took up our S O S, sending it out to all ships. Then the commander sent out a message, giving the position of the ship as she had grounded, and reporting that all the passengers were being safely launched in the ship's boats and were waiting for assistance.

"Then came the welcome news at quarter to eleven o'clock from the Eureka station, that the United States Life Guard crew had left Eureka fifteen minutes before and that the tug Relief would follow as soon as its crew was assembled. Just as we had received this information, the fog, lifting for a moment, showed Blunt's Reef Lightship abeam on our starboard hand, about six miles distant. This position was sent to the Eureka operator, who at once broadcasted it to all vessels in the vicinity.


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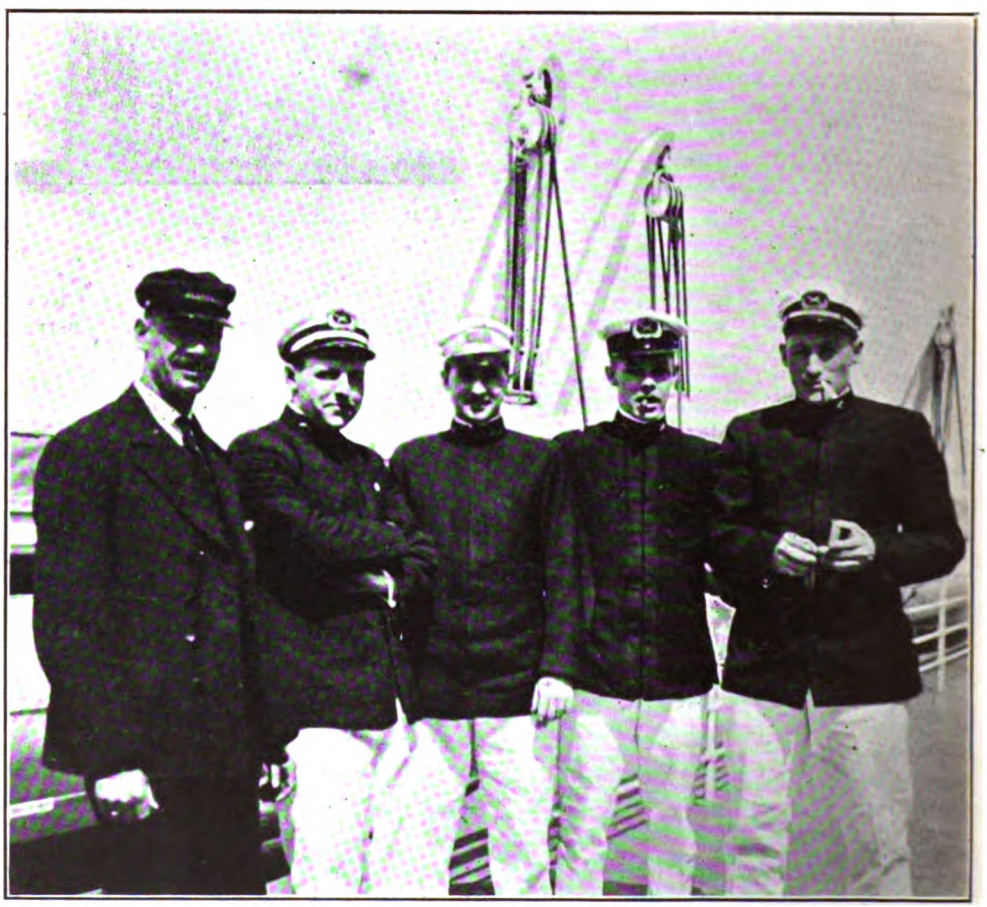
"The same operator informed us at 11:31 P. M. that the United States Battleship Oregon had obtained full particulars of our plight and would turn back to try to pick up the small boats, which were then adrift.

"Soon afterwards news also came from the commander of the steamship Grace Dollar, who sent a message stating that he was hurrying to our assistance and would reach Blunt's Reef Lightship by ten minutes to two o'clock the next morning. Another cheering message came later from the operator at Eureka, who certainly deserves unbounded credit for cool headedness and promptness in handling the situation. He now told us that the tug Relief was coming at full speed to our aid. As the various radiograms containing the welcome news of the relief expeditions were received, they were megaphoned from the bridge to the passengers getting away in the small boats, allaying their fears and inducing a feeling of confidence among them.

"At 11:52 a message was sent to the Eureka operator informing him that the captain's orders were to abandon ship. This was followed by a personal 'good-bye' and '30,' the telegraphers' finish."

The two Marconi operators stood by their ship until ordered by their commander to abandon her, and they left in the last boat. When it was discovered by the chief officer, who was in charge of this boat, that the captain and three others had been left behind, he returned to close proximity of the wreck with the intention of trying to take the four men off. He was ordered back by the com-



*A group of the officers of the steamship Bear. The captain refused to leave the ship when the others were taken off*

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mander, however, who regarded this as an undertaking too dangerous to be attempted.

All night long the boat was rowed about in the fog and cold. Added to these perilous conditions was the knowledge among the shipwrecked men that the course they were pursuing was beset with the treacherous rocks of Blunt's Reef. At length dawn arrived and with it the welcome sight of the tugboat Relief which picked up the little band. The Grace Dollar was also standing by and she aided the Relief in picking up the remainder of the survivors.

The Union Iron Works wrecking tug Iaqua left San Francisco late on June 15, arriving at the wreck on the following evening. Chief Operator Grabow of the Bear returned to the wrecked steamship the following day and began handling all traffic, being in constant communication with the wrecker Iaqua and the Eureka station. He remained on board for a week, engaged in salvaging operations, until all hope was abandoned for saving the vessel.

## A TESTIMONIAL TO OPERATOR CHAMBERLAIN

Mr. and Mrs. S. R. Chamberlain, of Sawtelle, Cal., the parents of George Ernest Chamberlain, the Marconi operator, who lost his life in the wreck of the steamship Roanoke off the California coast, on May 9, have received the following letter from Edward J. Nally, general manager and vice-president of the Marconi Wireless Telegraph Company of America, expressing appreciation of their son's services:

"I have heard with deep regret of the sad death of your son, who lost his life in the discharge of his duties while assigned as radio operator on the S. S. Roanoke of the North Pacific Steamship Company.

"We know there is little we can do to assuage the grief which is yours, but if there is any comfort in the thought that the memory of our wireless heroes is treasured throughout the Marconi service, please accept from this company its deep appreciation of the services rendered by your son and the sincere sympathy of all who have been his coworkers."

## NEW STATION LIST

The new list of "Radio Stations of the United States," edition of July 1, 1916, will contain the names, addresses, and call letters of all licensed amateurs of record in the Bureau on June 30, 1916, and where applications for station licenses were received after June 30, the names will not be published until the 1917 list is issued.

## NAVAL STATION NEARS COMPLETION

The new United States naval radio station at Chollas Heights, seven miles from San Diego, Cal., constructed at a cost of $300,000, will be put in commission about August 1. Seventy-two thousand feet of phosphor bronze wire are being used in the antennæ, which will swing from the apex of three 600-foot steel towers. These towers are completed. The sending instruments will be of 150-kilowatt capacity.

## STATIC BLOCKED MESSAGES

Wireless messages to be sent from the Sayville and Tuckerton stations were refused on June 27, because of the congestion of business. The Western Union Telegraph Company announced that static conditions in Berlin had interfered with the transmission of messages and that service had to be suspended to allow the operators to catch up.

## RADIO LINK TO PLANTATIONS

A complete wireless telegraph system will probably be installed by the Mississippi Delta Planting Company, from its offices in Memphis, Tenn., building to its six or seven plantations in Mississippi.

This announcement was made by L. K. Salsbury, president of the company, who said his object was to eliminate the cost of long distance telephoning, and to secure greater privacy and secrecy for his messages, which will be sent in code. The Memphis station is to be erected on top of the Central Bank Building, while there will also be substations at each of the farms.

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# From and For those who help themselves

## Experimenters' Experiences.

*The editor of this department will give preferential attention to contributions containing full constructional details, in addition to drawings.*

### FIRST PRIZE, TEN DOLLARS
### The Construction of a 1 k.w. Closed Core Transformer

The core for the transformer I am about to describe is built up of annealed soft iron strips having a thickness of No. 28 A. W. G. and of two sizes; the first set of strips should be 14 inches by 2 inches, and the second set 6 inches by 2 inches. A sufficient number of strips are required for each size to make two piles each 4 inches in height when compressed together. Two legs of the longer strips are built up to a height of 2 inches and in such a manner that 2-inch spaces are left alternately at the ends for the 6-inch by 2-inch cross pieces. When the legs are assembled they should be tightly taped and wrapped with empire cloth or oiled muslin to within 2 inches of each end and to a depth of ¼ of an inch.

Previous articles in THE WIRELESS AGE have told how to assemble the transformer core. The ends should be overlapped in such manner as to leave a space between the longer legs of about 4 inches in order to give the necessary clearance for the secondary pies. The laminations should be properly shellaced to cut down the Eddy currents and care should be taken to make the coating thorough.

The primary winding consists of about eight pounds of No. 10 double cotton covered magnet wire wound on one of the long legs to a depth of four layers; a space of ½ inch should be left at both ends of the insulating sleeve so that there will be no danger of the primary winding grounding on the core. The consecutive layers should be paraffined and insulated by several layers of empire cloth, as the electrostatic induction from the secondary circuits may puncture the insulation of the primary winding. To remove this danger a high capacity series type glass plate condenser should be shunted across the supply mains, as in Fig. 1.

The construction of the secondary coils will next be taken up. The fine wire for this winding should be reeled in thin pancakelike sections. The small hole in the center of the section should be large enough to allow it to fit snugly over the core and its insulation, which for this transformer will be about 2¼ inches square. A simple winder for the secondary pies may consist of a fan motor with a section winder bolted to the end of the shaft, as in Fig. 2. This winder or form consists of two discs of ¼ inch maple, 7 inches in diameter. Upon the face of one disc are fastened four iron pegs, spaced 2¼ inches apart. The wire is wound over these pegs between the walls of the disc until a section is formed about 6 inches in diameter. Twenty sections should be made in this manner. The size of the wire used in the secondary winding is No. 32 double cotton covered and for the purpose about nine pounds will be required.

After being wound, the secondary sections should be removed to a pan of melted paraffine for impregnation. Al-



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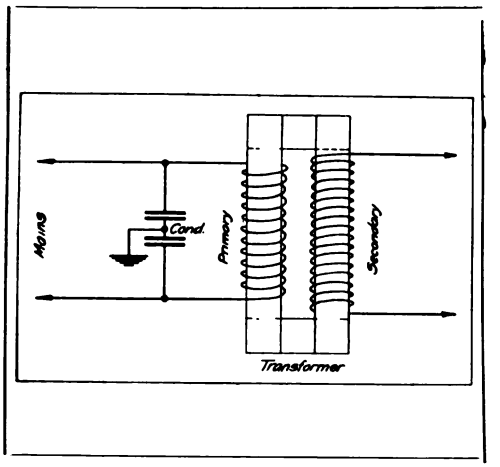


*Fig. 1, First Prize Article*

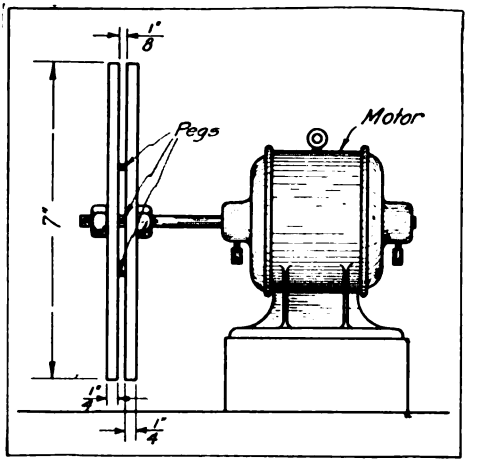


*Fig. 2, First Prize Article*

low the coils to remain in this insulating mixture for at least fifteen minutes until all the air bubbles cease rising. They should then be pressed between marble slabs until cold and afterwards taped, particular care being observed that the wires do not become kinked. Note should also be made of the direction in which the secondary windings are wound.

Inasmuch as the secondary output of this transformer is 20,000 volts, a potential difference of about 1,000 volts will exist between the consecutive sections. Circular separators of oiled or empire cloth 6½ inches in diameter should be placed to relieve the strain between the successive pies.

To complete the assembly of this transformer, clamp the core leg in a vise and slip a section on to it within 2 inches of the lower end of the insulating sleeve. A separator should then be placed against this section and the inside turn of the wire brought out under it. After observing the direction that this turn takes, another section should be lowered into position in such a manner that its inside turn runs in the opposite direction to that of the first coil. The wires should be scraped clean with a sharp knife and soldered and taped. Another separator and section should be placed on the leg and the outside turn of the previous section connected to the outside turn of that one. Assemble the entire secondary winding in this manner, taking care that the turns of each section run in the opposite direction to the preceding one, as per Fig. 3.

If a mistake is made in the connections of the secondary winding this transformer will not operate at full efficiency.

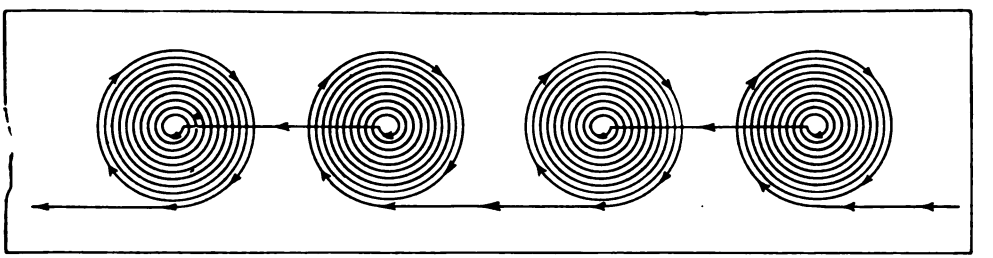

*Fig. 3, First Prize Article*

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After the secondary winding is completely assembled heated wax should be poured over it until all the spaces between the sections are filled. This has the effect of increasing the electrical and mechanical strength of the transformer. The end pieces of the core between the primary and secondary windings may now be inserted, and the complete transformer mounted in a case to suit the builder, or it may be immersed in a metal tank filled with boiled linseed oil. If it is placed in a metal tank a space of 2 inches should be left between the windings and the sides of the tank to prevent sparking.

If the foregoing instructions are carried out carefully the resulting product will be a very efficient transmitting transformer.

HERMAN E. WERNER, *Ohio.*

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## SECOND PRIZE, FIVE DOLLARS

### An Experimental Arc Gap for Radio Telephony

In the past, to obtain the best results from a radio phone arc, an atmosphere of illuminating gas, a circulating cooling system, and, in the majority of designs, special parts were required which could not be found in the usual amateur's work shop. The writer endeavors to present herewith a new design for a radio telephone arc, which generates its own atmosphere, is self-cooled and made of such material that it may be assembled with a standard set of tools at very little expense.

A fair idea of its construction is shown in Fig. 1, which will be described fundamentally, leaving the minor parts to the ingenuity of the constructor. The base for the arc is formed by a marble slab, ½ inch in thickness and 5 inches square. This is drilled to accommodate screws to clamp the pipe flange and the copper anode in place. The bottom flange is fitted with a short length of 2¼-inch iron piping as shown. The main body of the arc fits into this pipe, which is formed by a standard 2-inch piece of iron piping, 5⅜ inches in length. These pipes should be constructed to slide easily within each other and if they do not they may be ground with emery paste and machine oil until the desired results are obtained.

The copper electrode for the arc is ¾ of an inch in diameter and 2 inches in length, drilled and tapped at one end for a 10-32 screw, while the opposite end has 4 equally spaced ⅛-inch holes drilled parallel with its axis with a second set of holes drilled radially to connect with these. The purpose of these holes will be apparent shortly.

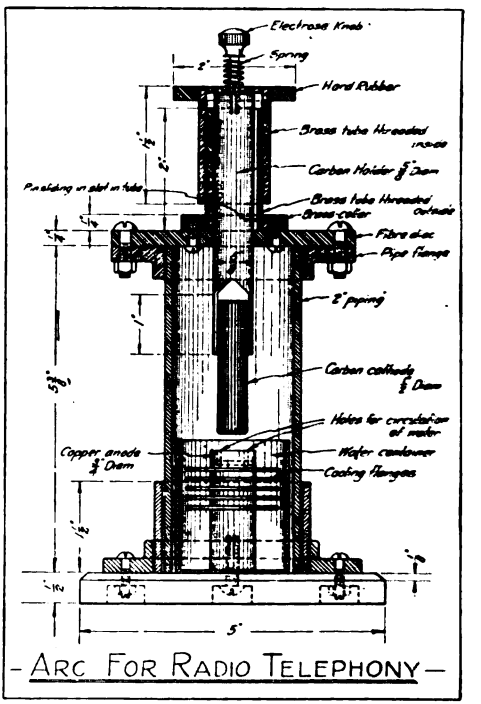


*Fig. 1, Second Prize Article*

Four or five heat distributing vanes cut from sheet copper and forced into place surround this electrode. A metal container also surrounds the copper electrode and is ¼ of an inch higher than the latter. This vessel holds the water around the copper and is firmly held in place by a screw in the bottom.

Attention is next directed to the regulating mechanism. A fibre disc is

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firmly bolted to the upper flange with a gasket between them. A 5/8-inch hole is drilled in the center of this disc to pass the carbon holder. A brass collar, 1 5/8 inches outside diameter, 1/4 of an inch in thickness, is threaded with a female thread for piping and held in place by 4 machine screws. Threaded into this collar is a piece of 5/8-inch brass tubing, 2 inches in length, which has a slot cut in along its length to take a small pin which enters into the carbon holder. This pin prevents the holder from turning as it is fed down.

A piece of 3/4-inch tubing, 1 1/2 inches in length, is threaded to go over the above tube and one end of it has a disc of brass soldered into it. A fibre or hard rubber washer is forced over it to act as a knob. A hole is drilled through the closed end to pass an 8-32 screw.

The carbon holder proper is a piece of 5/8-inch brass tubing or rod. A 1/2-inch hole is drilled to a depth of one inch in one end. The edges of the tube are split by a hack saw to grip the carbon tightly. An 8-32 threaded rod is fitted into the upper end and extends 3/4 of an inch above the same.

The arc feeding mechanism is assembled as shown and clamps in position on the body of the tube. Connections are then made to the copper electrode and brass collar. Since the iron casing is not in the circuit, there is no danger from shock if the casing is accidentally touched.

A few words concerning the manipulation of the arc are now in order. The arc is struck by depressing the small knob at the top and then releasing it. It is adjusted by slowly turning the knob below it. When the arc is finally in operation it will heat the water in the container and the steam given off acts as an atmosphere of gas; in fact, tests have proven a steam surrounded arc to be as stable as with any other gas that could be used for the purpose. If it is intended to operate the arc for a long period means must be provided for renewing the water. This may be accomplished by passing small pipes up through the base, one to the supply of water and the other to act as a drain, the precaution being taken to keep the top of it level with the top of the copper anode. The holes in the copper allow the water to flow close to the arc and assure the steady generation of steam immediately in the vicinity of the arc proper.

The remaining parts required for a wireless telephone set are choke coils, a regulating rheostat, a microphone transmitter, a condenser and an oscillation transformer.

Choke coils can easily be made by winding three layers of No. 16 double cotton covered wire on a core of soft iron, 1 inch in diameter and 8 inches in length. Two coils are required, one in each current lead, to prevent the condenser from discharging back into the dynamo.

A satisfactory rheostat may be constructed of a bank of 5 or 6 32 c.p., 110

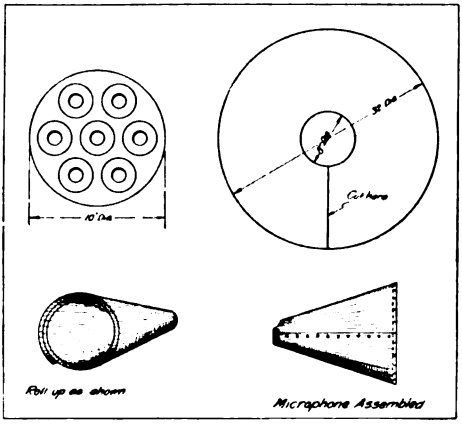


*Fig. 2, Second Prize Article*

volt incandescent lamps, arranged with switches, so that they may be cut in or out of the circuit as desired. Very satisfactory results can be obtained when the arc passes from 5 to 6 amperes.

The condenser is one of small capacity; it may be of the rotary plate type, which can be filled with castor oil to increase the insulating qualities as well as the capacity. This makes a very convenient condenser and will be found superior to the usual glass plate type.

A number of designs for oscillation

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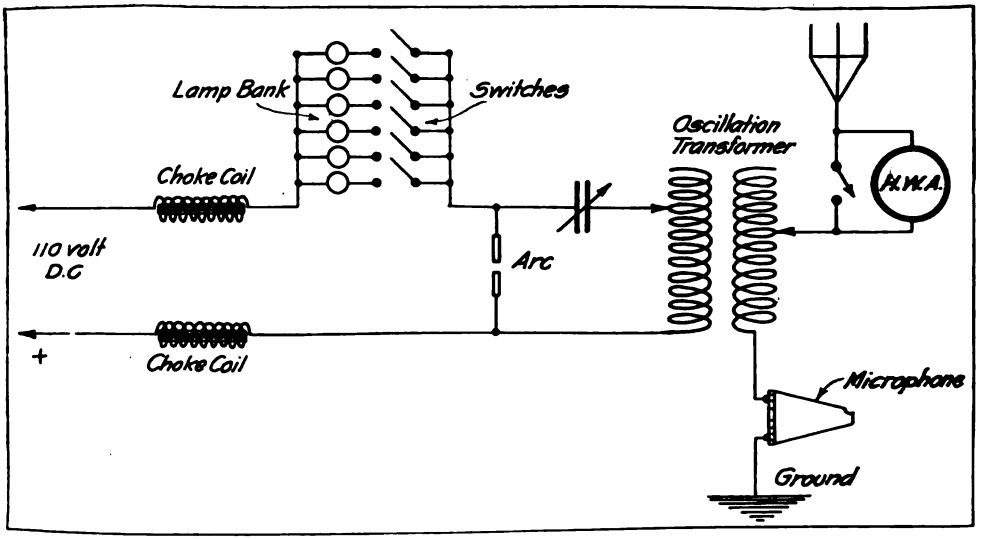


*Fig. 3, Second Prize Article*

transformers have been published in previous issues of THE WIRELESS AGE, and consequently detailed instructions will not be given. It is sufficient to say that one having a fairly large range of coupling should be selected. An oscillation transformer of the spiral type is very convenient and extremely easy to construct.

The greatest problem is presented in the construction of the microphone. A good one for purposes of wireless telephony can be made as follows: Cut out a circular piece of wood, 10 inches in diameter and ¼ of an inch in thickness. Mount on this, as shown in Fig. 2, several ordinary telephone transmitters equally spaced and connected in parallel. A horn is now constructed to cover the entire set of transmitters. On a piece of heavy cardboard lay out a circle 32 inches in diameter and another 8 inches in diameter, using a common center for both. Measure a distance of 31 inches around the larger circle, mark the points and draw a line from these points to the center.

Cut out the cardboard along the heavy line; by rolling this piece around the wood disc it will form a horn. Next tack the cardboard to the wood and fasten the overlapping edges with paper fasteners and glue. A notch is cut out to allow the insertion of the nose while talking. This microphone is mounted against the wall at a convenient height and given a coat of shellac or covered, if desired, with cloth. Its current carrying capacity is about 2 amperes continuously without heating.

A diagram of connections for the entire apparatus is given in Figure 3. The microphone may be connected in at several different points of the complete set, but it is preferred to connect it in series with the earth lead from the secondary winding of the oscillation transformer. The entire set I have described was designed to handle a ½ k.w. and will give a range from 10 to 25 miles, depending, of course, upon the aerial and the surrounding country. A wave-length of 800 to 1,000 meters may be employed, but a wave-length in excess of 2,500 meters gives the best results. The circuit should be carefully tuned with the wave-meter if long range is desired. Conditions of resonance between the two circuits may be obtained by means of a hot wire ammeter connected in series with the antenna circuit.

THOMAS W. BENSON, *New York.*

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## THIRD PRIZE, THREE DOLLARS
## A ½ K. W. Panel Transmitting Set That Has Found Favor

The panel type of transmitting apparatus has found general favor among amateur experimenters and is growing in popularity. With the set about to be described it will be comparatively easy for the amateur to comply with the Government restrictions in regard to wave-length, power, etc. In addition, the equipment should be efficient because of the shortness of the connections in the circuits of radio frequency and the overall compactness and ease of adjustment obtainable.

For the mounting of the instrument a piece of slate or marble, ¾ of an inch by 16½ inches by 33½ inches. is required which should be drilled for the necessary switches. The dimensions of the panel board are included in the drawing of the front elevation.

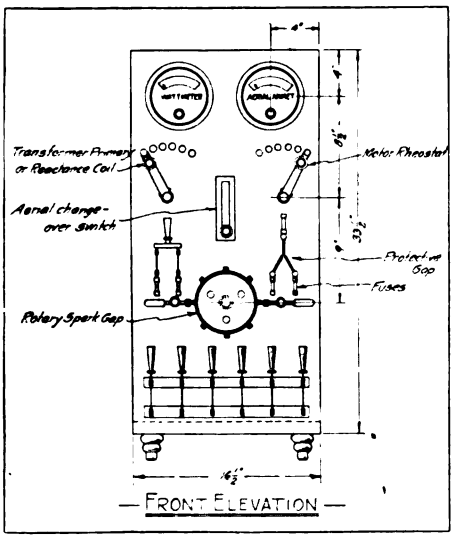


*Fig. 1, Third Prize Article*

At the top of the panel and to the left is mounted a watt-meter, and to the right an aerial hot wire ammeter. In the center, immediately below the meter, is placed the aerial changeover switch, which is mounted in a novel manner, the switch proper being mounted on a bracket shelf at the back of the panel with the handle protruding through an opening so that it may be operated from the front (not side elevation). This opening should be fitted with a brass slideway to give it a neat appearance.

To the left of this switch is placed the transformer primary tap-off switch, which could be, if desired, connected to a reactance or choke coil. To the right is mounted a rheostat for the control

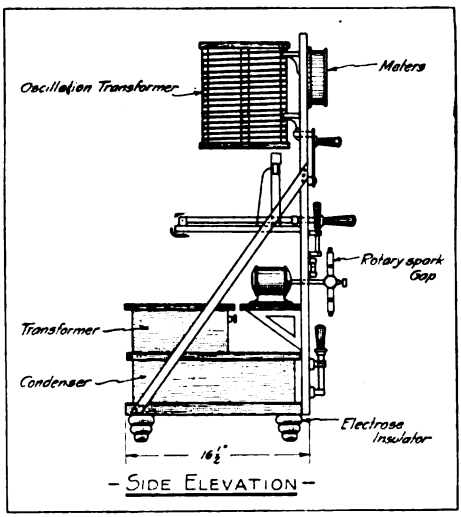


*Fig. 2, Third Prize Article*

of the speed of the non-synchronous rotary spark gap. These switches are of the usual construction, but care should be taken to have them of sufficient carrying capacity for the purpose.

The rotary gap is mounted immediately below these switches in the same manner as the antenna switch, that is to say the motor is mounted on a shelf supported by a bracket at the rear of the panel; the shaft of the motor is extended through a steel bearing in the panel with the disc for the rotary attached on the front. Suitable means should be provided for the lubrication of this bearing.

To the left and above the rotary gap is the power switch which is fitted with a fuse box for connecting the 110-volt alternating current mains to the apparatus; to the right a suitable protective device is mounted for protection of the primary circuits from electrostatic induction.

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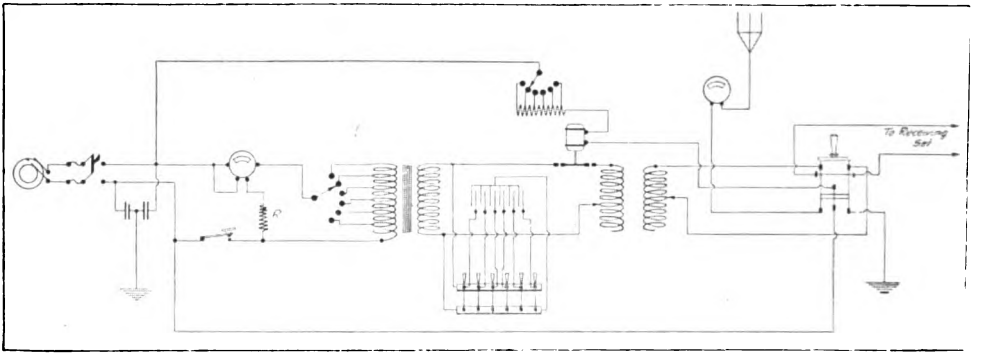


*Fig. 3, Third Prize Article*

Immediately at the bottom of the panel board is placed a six section condenser switch consisting of six single pole switches with clips mounted on two strips of bus copper, 1 inch in width. A piece of oak is fitted at right angles to the panel at the bottom and suitably braced by steel strips. On this base is mounted first the condenser, second the transformer; the oscillation transformer is mounted at the top of the panel by brackets. The complete panel board is placed on electrose insulators.

The correct diagram of connections for this apparatus appears in Fig. 3 and although a complete and detailed description of the associated parts of the apparatus has been omitted, the correct dimensions can be obtained from the book "How To Conduct A Radio Club," published by the Marconi Publishing Corporation. It is hardly probable that any amateur designer will follow my design in detail, but if the general outline is adhered to, an efficient and compact set will result.

ARTHUR C. BURROWAY, *Ohio*

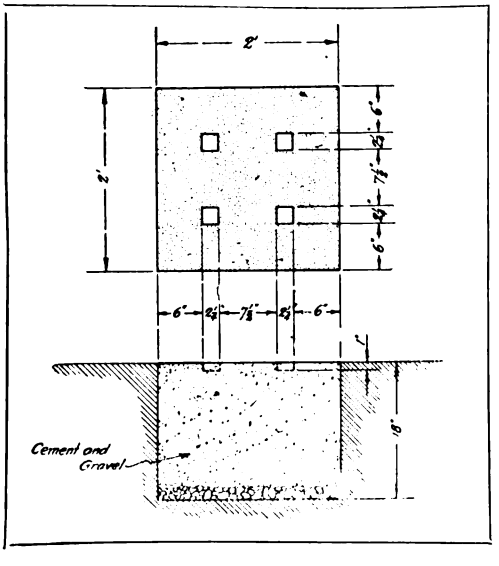


*Fig. 1, Fourth Prize Article*

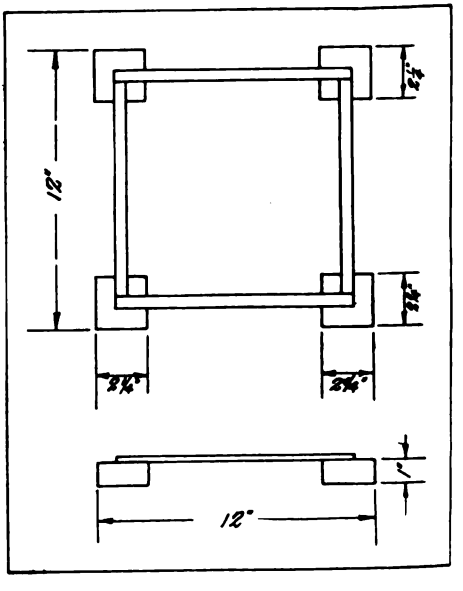


*Fig. 2, Fourth Prize Article*

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## FOURTH PRIZE, SUBSCRIPTION TO THE WIRELESS AGE

### The Construction of a 100 Foot Tower

I wish to describe the construction of a 100 foot wireless tower, but I believe my design will appeal only to those amateurs who are ambitious to continue their experiments beyond the stage of self-amusement. It is, however, hoped that all readers will obtain some ideas from this article, which will aid them in improving their own stations.

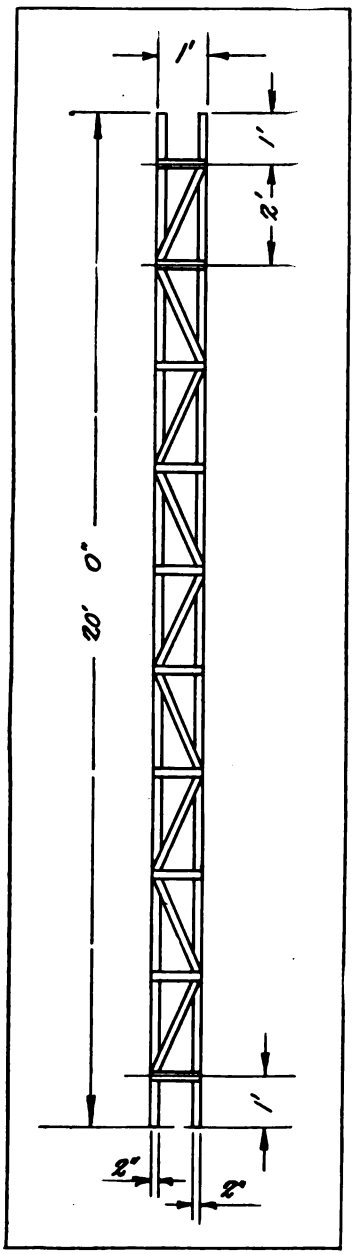


*Fig. 3, Fourth Prize Article*

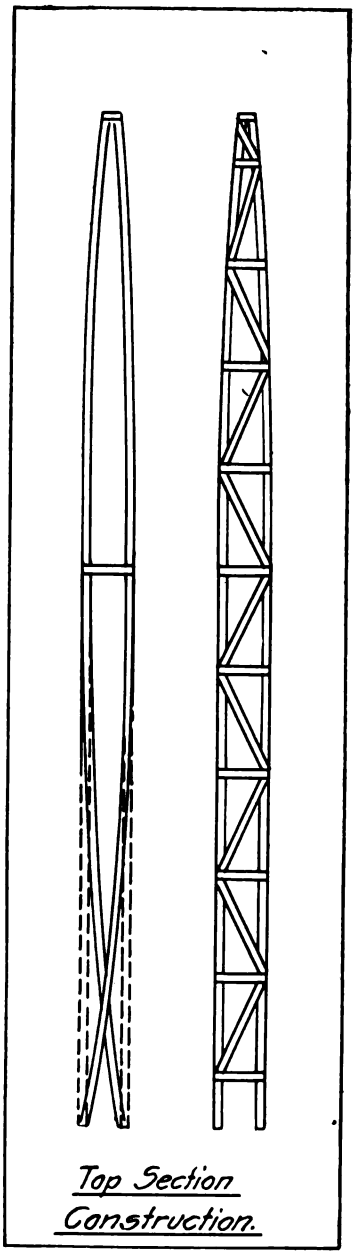


*Fig. 4, Fourth Prize Article*

To construct the mast I have designed the following materials are required:

For the base, 1 sack of Portland cement, and a quantity of gravel and

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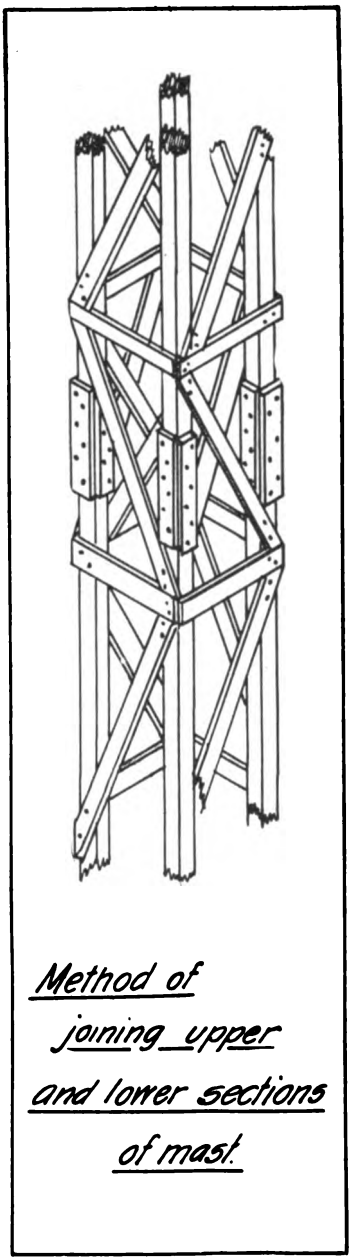


*Fig. 5, Fourth Prize Article*

stone; for the tower, 250 feet of 2 inch by 4 inch lumber, ripped to 2 inches by 2 inches, and 525 feet of 1 inch by 3 inch lumber, ripped to 1 inch by 1½ inches. The 2 by 2's should be 20 feet in length.

The miscellaneous material required is:

Twenty pounds of 2½-inch boxing nails, two gallons of green paint, and 3,500 feet of 3-16-inch 7-strand steel cable.

In the construction of the base, a hole 2 feet square is dug to a depth of

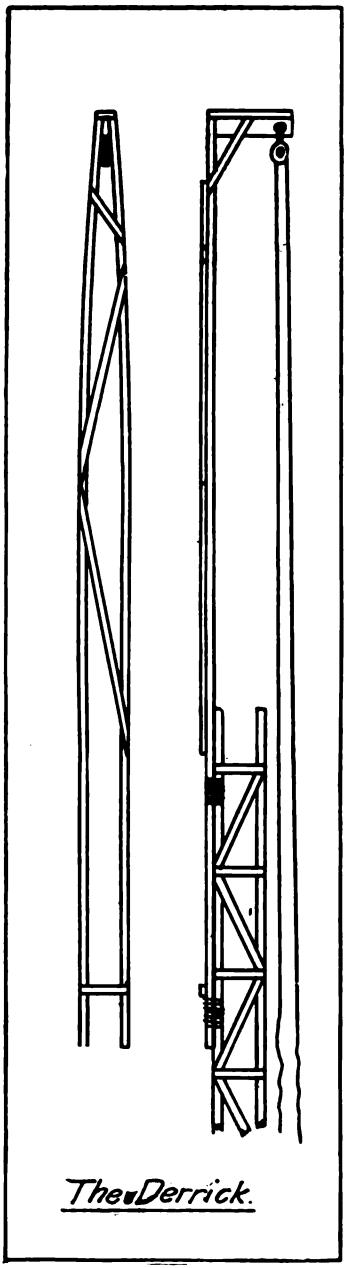


*Fig. 6, Fourth Prize Article*

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about 18 inches and the bottom covered with large stone (Fig. 1). The cement and gravel are mixed in the proportion of 1 to 4; then mixed with water and poured in on the stones until the mixture rises nearly to the edge of the hole. While the cement is still wet a light frame carrying blocks, 2¼ inches square and 1 inch in height, is placed on the base so that the blocks are buried in the cement (Fig. 2). When the base has set, the blocks are withdrawn and four holes are left in which the bottom of the tower rests.

In building the sections the 2 by 2's are matched up in sets of four—one for each section. Then two sides are constructed, as in Fig. 3; they should be joined in the same manner, making a rigid section 20 feet in length.

The top section is modified somewhat, in order to give it a more finished appearance. The 2 by 2's, instead of being parallel, are laid out as in Fig. 4. The free ends are then drawn together, as in the figure, which bows the 2 by 2's, as shown in the drawing. Cross pieces are then nailed on, while the 2 by 2's are curved. When the upper half is complete, the ends of the 2 by 2's are let loose and the lower half is completed in the same manner as the first one.

Two 20 foot sections are joined together and up-ended in one piece, after the manner in which telephone poles are raised. The completed joint is plainly shown in Fig. 5.

When this section is raised and guyed, a derrick, as shown in Fig. 6, is carried up to the top of the structure and lashed in position. By means of the block and tackle attached thereto the next section is raised and held in position, the joint being made as previously described.

Guy wires are run from each corner at the top of each section to four large trees, each being more than 100 feet from the base of the tower.

The cost of the material for the construction of this mast varies widely in different parts of the United States, but in general a tower of this type should be constructed at an expense of about $30.

JAMES A. TILTON, JR., *Massachusetts.*

## POLICE CLASS AT BROOKLYN Y. M. C. A.

The members of the newly organized wireless class of the New York City Police Department, Sergeant Pearce in charge, were entertained at the Radio Laboratory of the Eastern District Y. M. C. A., Marcy Avenue, Brooklyn, on the evening of June 23rd. The long distance receiving set recently installed at the Y. M. C. A. was the principal object of attention, the policemen spending the greater part of the evening in copying messages from high-power stations in the United States and abroad.

Unusually effective results were obtained by the use of this set, which has a daylight receiving range of 3,500 miles and a night range of 5,000 miles. The tests were conducted by Elmer E. Bucher, instructing engineer of the Marconi Wireless Telegraph Company of America, who explained in detail the circuits of the set. His explanation was followed by experiments on a standard 2 k. w. Marconi commercial radio set and also on a special Boy Scout transmitting and receiving set. Additional tests were made with a wavemeter and other testing apparatus, to demonstrate the principles of electrical resonance in wireless telegraphy.

The radio laboratory at the Y. M. C. A. has been used for the initial experiments on the junior military portable wireless apparatus designed by the Marconi Company for the National Amateur Wireless Association.

The members of the Eastern District Marconi Club, the headquarters of which are at the Eastern District Y. M. C. A., invite other organizations to visit the laboratory at prearranged dates. Appointments for demonstrations can be made by addressing L. H. Brown, Educational Director, Eastern District Y. M. C. A., Marcy avenue, Brooklyn, N. Y.

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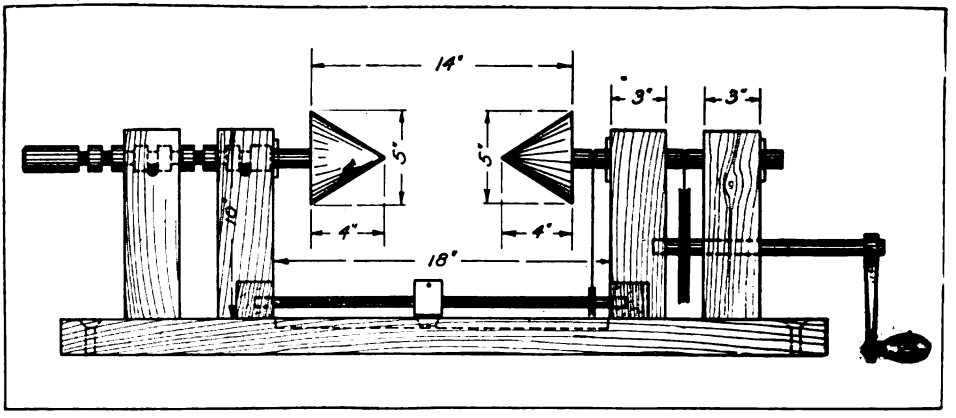


*Fig. 1, Honorary Mention Article, Bayard B. Alcorn*

## HONORARY MENTION

### A Winding Machine That Every Amateur Requires

Although I have been an enthusiastic reader of constructional articles appearing from time to time in THE WIRELESS AGE, I have so far failed to see a description of a satisfactory

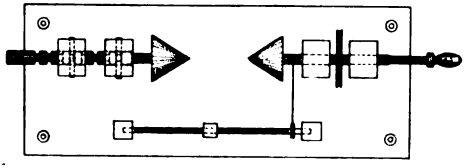


*Fig. 2, Honorary Mention Article, Bayard B. Alcorn*

winding machine. As every experimenter knows, the construction of a radio set involves the winding of a number of coils and the operation is rather tedious when done by hand.

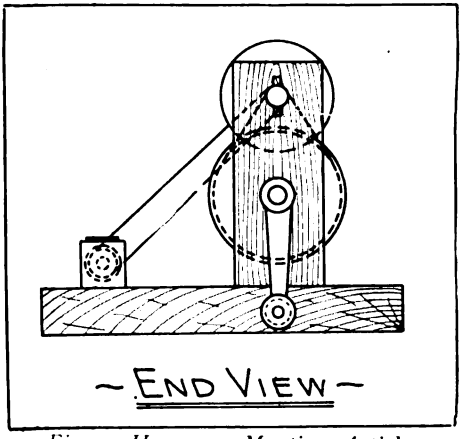


*Fig. 3, Honorary Mention Article, Bayard B. Alcorn*

A suggested design for a winding machine is given in Figs. 1, 2, 3 and 4, the dimensions of which it is believd are satisfactory for the average amateur's work. The drawings with the accompanying dimensions are largely self-explanatory. The cones should be geared to turn three times to one turn of the crank and the traveller should

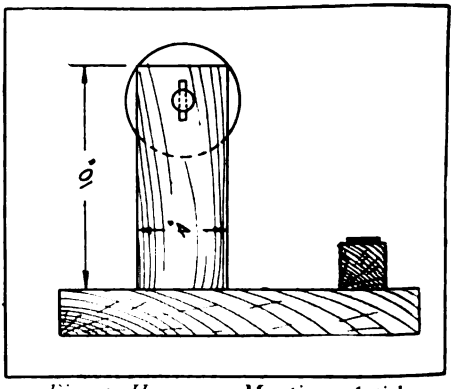


*Fig. 4, Honorary Mention Article, Bayard B. Alcorn*

turn about the same speed as the cones. Any tube from the smallest up to five inches in diameter can be wound on this machine—in fact tubes of greater size can be accommodated by increasing the size of the cones. The dimensions given are the best suited for general work, but may be varied, of course, to suit the builder.

While the standards for the bearings are preferably made of metal, it is obvious that they can be made of wood and fulfill the purpose required.

BAYARD B. ALCORN, *New Jersey*.

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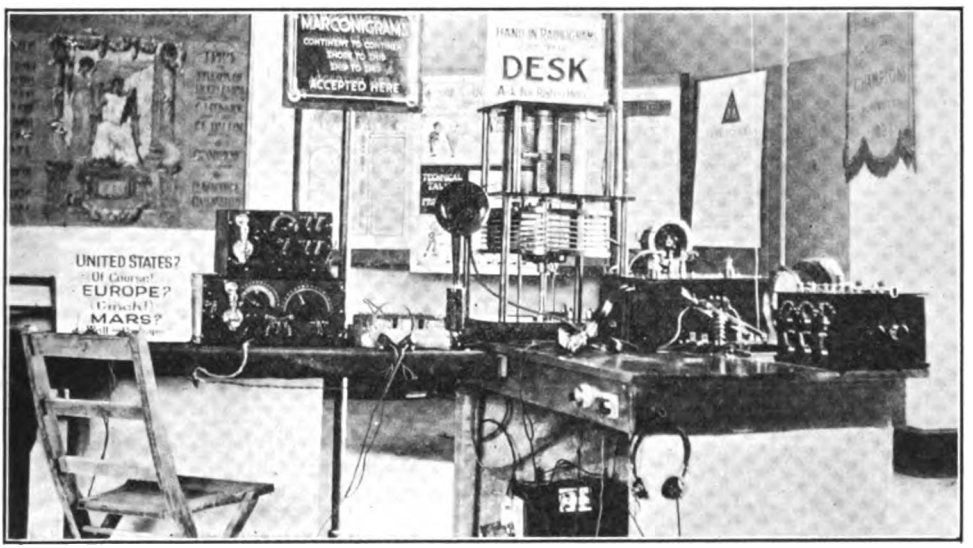
# The Bunker Hill's Wireless Log

## Transmitting News of the Massachusetts Institute of Technology's New Building Celebration by Radio




*The amateur set installed on the new Institute building*

PROMINENT among the features of the events attending the dedication of the new building of the Massachusetts Institute of Technology on the Charles River, on June 14, was the demonstration of wireless telegraphy by the Marconi Wireless Telegraph Company of America on the steamship Bunker Hill, which carried the alumni of the Institute and their guests from New York to Boston. The company's exhibit of radio apparatus in the new building, showing the various types of equipment from the early days of the art to the present, also attracted considerable attention.

The Bunker Hill, equipped with a Marconi wireless set, left New York early in the evening of June 11, the passengers including many who have made their mark by notable achievements. The arrangements for the trip were in the hands of L. D. Gardner, an alumnus of the Institute. In charge of the wireless equipment was David Sarnoff, assistant traffic manager of the Marconi Wireless Telegraph Company of America, aided by Arthur D. Moulton as first operator and Walter J. Henry, as assistant. Particular interest is attached to the operation of the Bunker Hill's wireless because of the fact that, through the courtesy of Edward J. Nally, vice-president and general manager of the Marconi Company, The Tech, published in Boston by students of the Institute, was enabled to receive the news of the trip direct from its correspondent on the vessel, by means of radio.

The complete "story" of the Bunker Hill's voyage, was sent by wireless, the first dispatch being dated Saturday (June 10), 11:30 P. M., at the Technology Club, Gramercy Park, New



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York. The next marconigram was flashed from the Bunker Hill while she was off the Battery, on the following evening at six o'clock.

In describing the arrival of the passengers on the vessel, the reporter wirelessed as follows: "During the afternoon, Frank B. Gilbreth, the well-known engineer, who is a 'movie' enthusiast, as well, commenced filming the crowd. He caught Mr. Orville Wright, while he was in the act of explaining to Mr. Alan R. Hawley, president of the Aero Club of America, how he expected that soon the aeroplane would be sailing out of the harbor, rising into the air and landing a few hours later on the other 'side.' Rear Admiral Coops, and another distinguished guest, were caught explaining to the ladies the mystic ceremony of 'keelhauling.' Mr. Philip J. Roosevelt, a guest of aeronautic leanings, and a cousin of T. R., was explaining how it all happened.

"The ship is now rounding the Battery. The Woolworth Building is being illuminated in honor of the alumni, through the courtesy of Mr. Frank Woolworth."

Continuing his snapshot impressions of the voyage, the Tech man filed a marconigram, dated, "Passing Through Hell Gate." It read: "Hell Gate is being raised. A messenger has just announced that a Roman submarine has been sighted off the port bow. Everyone is being ordered on deck. The engines have stopped and Neptune (an alumnus in costume), has hailed the captain of the submarine (also an alumnus) who has appeared on deck wearing the service uniform of a Roman gladiator."

The next message, dated "Entering Long Island Sound," told of a conversation that took place between Neptune and the "captain" of the "submarine."

When the Bunker Hill was off Saybrook, Conn., the following dispatch was flashed: "Rockets are now being seen on the shore . . . where '96 is having its outing. Cardinal and gray flares signify their celebration."

"On board Bunker Hill leaving Long Island Sound, Monday, 1:20," read the succeeding marconigram. "Final message. Boat well under way. Everyone happy and hoping for good weather. The Marconi wireless, through courtesy of Mr. E. J. Nally, placed equipment on board for receipt of congratulatory messages. . . . Full details tomorrow."

These messages were received at the Boston station of the Marconi Company and immediately delivered to the office of The Tech, enabling that publication to print a complete account of the trip of the Bunker Hill and place it on sale on the vessel when she arrived off Boston Light on the morning of June 12.

Throughout the trip the wireless equipment was one of the principal objects of interest. Messages were sent through the land stations at Sea Gate, Siasconsett and Point Judith, R. I., the latter station being used by courtesy of the National Signaling Company. Messages received from Arlington were amplified to such a degree that they could be distinctly heard by passengers on the deck outside the wireless cabin. Special receiving apparatus was installed on the Bunker Hill by Mr. Sarnoff, and wireless telephone experiments were conducted between Roy A. Weagant, chief engineer of the Marconi Company, who was in charge of the wireless telephone installation at the Marconi laboratory at Aldene, N. J., and Mr. Sarnoff on the steamship.

Included in the Marconi Company's exhibit in the Institute building were the first type of transmitting key and oscillation transformer used. In contrast to the old equipment was shown modern apparatus consisting of a ½ k.w., 500 cycle panel set. The exhibit was explained by G. W. Nicholls, manager of the Marconi station in Boston.

An amateur station was installed on the new building and messages were transmitted to the Marconi station on the Filene Building, in Boston, whence they were flashed to various parts of the country. Among those who wirelessed greetings to the Institute alumni was George S. De Sousa, traffic manager of the Marconi Company. His marconigram was sent from the steamer Antilles in the Gulf of Mexico.

Several expressions of thanks for the aid given by the Marconi Company were received by Mr. Nally, who in replying

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referred to the company's gratification at the appreciation shown.

H. E. Lobdell, general manager of The Tech, wrote as follows: "Permit me to express the appreciation of The Tech for the courtesy extended to us by yourself and the Marconi Company. By it we were enabled to place a complete story of the voyage of the Bunker Hill on sale on the boat off Boston Light Monday morning.

"The alumni on board felt that the Marconi Company had conferred a distinct honor on the New Technology by this aid. Needless to say the issue caused great comment on the perfection of the Marconi system."

"All messages came through with promptitude and accuracy," read a message sent on behalf of the Bunker Hill's passengers.

"I wish to express to you our appreciation for the splendid wireless demonstration which you gave on the Bunker Hill," wrote L. D. Gardner. "Everyone spoke in the highest terms of your courtesy and I assure you that it has been greatly appreciated.

"I also wish to thank you for the wireless exhibit. . . . It was splendidly placed and the thousands of guests were evidently very much interested."

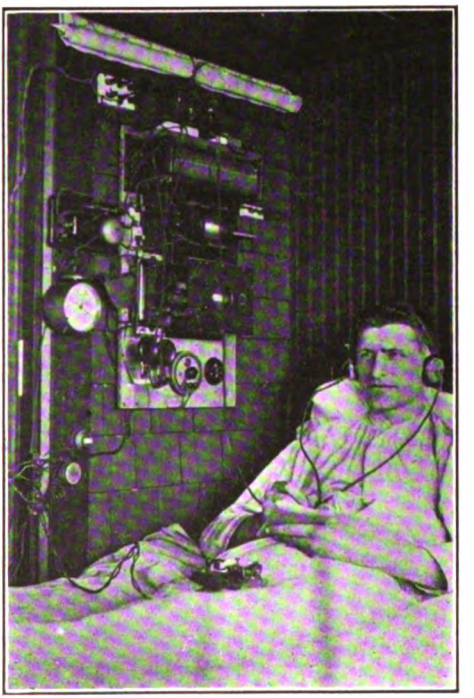
At a meeting of the Committee on Exhibit, "Fifty Years of Technology," Alumni Association of the Institute, it was unanimously voted that the thanks of the Committee and through them of the General Committee on the Dedication Reunion, be extended to the Marconi Company for the loan of the apparatus at the exhibit.

# A Station in a Hospital

## The Story of the Achievement of a Bed-Ridden Patient in a Pittsburg Sanitarium

A NEW application of the humanitarian use to which wireless telegraphy can be put has been revealed by the activities of Paul F. Shuey, a patient in the Tuberculosis League Hospital, Pittsburgh, Pa. Shuey, who is a graduate of a university, was studying to obtain a fellowship at the Mellon Institute for Scientific Research when he was stricken with illness. Sent to the hospital, he found time hanging heavily on his hands until he installed a set by his bedside.

By means of this station Arlington time signals, the baseball scores and war news are received. Extensions to various wards enable other patients to listen to messages flashed from all parts of the country. They also give them the privilege of hearing concerts and other musical entertainments in the hospital with out leaving their beds. The study and practice of the code are now being pursued by a considerable number of the patients.



*Paul F. Shuey operating his set*

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## VESSELS RECENTLY EQUIPPED WITH MARCONI APPARATUS

| Names. | Owners. | Call Letters. |
|---|---|---|
| Geo. E. Paddleford | Petroleum Transport Co. | WIV |
| J. M. Danziger | Petroleum Transport Co. | WIW |
| Cape Cod | Captain F. H. Ely. | KPW |
| Tug Clincher | Clinchfield Navigation Co. | KMC |
| Admiralen | Crew Levick Co. | LFN (temporary) |
| Avellaneda | Oriental Navigation Co. | LMK |
| Theo. Roosevelt | Roosevelt S. S. Co. | WCT |
| Maitland No. 1 | Toronto, Hamilton & Buffalo Ry. Co. | WLE |

## THE SHARE MARKET

NEW YORK, July 6.

Marconi issues on the curb today were particularly strong, the brokers assert, American shares showing better than a half point advance over our July issue's report and gains of two and three points being registered in the English issues. Canadian Marconi shows a fractional advance also, after a long period of inactivity. It was pointed out that the advances on the New York curb had not yet caught up with the foreign market, however, American Marconi being sold a point higher in London and English ordinary shares at a two point advantage. A definite rumor was afloat that the market would soon feel the influence of general buying, in anticipation of favorable announcements. The quotations on Marconis remained firm from the opening of the day's trading until its close.

Bid and asked quotations today:

American, 3⅝—3⅞; Canadian, 2—2½; English, common, 13—16; English, preferred, 12—15.

## MARCONI SHIP OPERATORS RECEIVE ACCIDENT POLICIES

An augmentation of the insurance plan of the Marconi Wireless Telegraph Company of America, details of which were published in the May number of THE WIRELESS AGE, has been announced by Edward J. Nally, vice-president and general manager of the company. Under the terms of the addition to the plan ship operators in the Marconi service will be provided with $500 accident policies, without expense to themselves. The announcement follows:

"It gives me much pleasure to announce an extension of the Company's Insurance scheme which became effective April 1, 1916. As a further mark of appreciation for the work performed by our ship operators, the company desires to provide some protection for them until such time as they are eligible for regular life insurance, and it has therefore arranged with the Ocean Accident and Guarantee Corporation, Ltd., to furnish without expense to ship operators not insured under the company's life plan, a $500.00 Accident Insurance Policy.

"The policy will be valid for one year, and cover loss of life, both hands, both feet, one hand and one foot, or the sight of both eyes, by accident, in the amount of $500.00.

"Should the operator, upon passing into the Life Insurance class, desire to continue the accident policy arrangements have been made whereby he may do so at exceptionally low rates.

"It is necessary for each ship operator, of less than one year's service, to fill out an application form, in which the insured may name his own beneficiary. A service form properly filled out should also accompany the application form.

"Should a ship operator leave our employ before completing one year's service, the policy will be terminated. Each new ship operator should be required to fill out accident insurance papers, immediately upon entering the service."

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# Queries Answered

Answers will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all letters and only one side of the paper written on; where diagrams are necessary they must be on a separate sheet and drawn with India ink. Not more than five questions of an individual can be answered. To receive attention these rules must be rigidly observed.

**Positively no Questions Answered by Mail.**

N. B. Hill, Milwaukee, Wis., inquires:

Ques.—(1) I employ an aerial composed of four No. 12 copper wires, 250 feet in length, 125 feet in height, with a lead-in of 80 feet. It is connected to a standard set of receiving apparatus and makes use of a galena detector. With this equipment how far should I ordinarily be able to receive; also what is the wave-length of this aerial?

Ans.—(1) The fundamental wave-length of this aerial is approximately 575 meters, which probably will require a short wave condenser in series with the primary winding for the reception of wave-lengths of 600 meters. You, of course, understand that this aerial is too long for the reception of signals from amateur stations at the wave-length of 200 meters. If you are an operator, familiar with the characters of the Continental Telegraph Code, you probably can find out more accurately for yourself just how far this apparatus will receive than we could tell you. You should have no difficulty during the favorable months of the year in hearing the stations located on the Atlantic coast. Your daylight range can best be determined by experiment.

Ques.—(2) Can I use a ¼ kw. Hytone transmitting set with an aerial composed of 12 wires, spaced one foot apart? It is 100 feet in length and 100 feet in height. The lead-in is 60 feet in length. Also what is the wave-length of this aerial?

Ans.—(2) The natural period of the antenna is 395 meters, which is a little too long to be operated at the wave-length of 200 meters. There is no reason, however, why the Hytone set could not be employed in connection with it, but you must take particular care that you do not exceed the restricted wave-length of 200 meters. Your aerial could be made suitable for transmission at the wave-length of 200 meters by attaching the lead-in wires to the center of the flat top portion.

Ques.—(3) What distance could I expect to cover with this transmitting set in daylight or after darkness?

Ans.—(3) The range is problematical. The average amateur transmitting set in your district communicates from forty to sixty miles in daylight—sometimes further—and from 500 to 800 miles after dark. Reports of long distance working on the part of amateurs appear in THE WIRELESS AGE and should be of interest to you.

* * *

W. K. Galveston, Texas, inquires:

Ques.—(1) Please tell me the approximate fundamental wave-length and the capacity of the following aerials: The first one is composed of two No. 6 wires, 650 feet in length, 95 feet in height at one end and 45 feet at the other; the spacing is 4 feet and the lead-ins 25 feet. The second aerial is composed of five No. 10 wires, spaced 3 feet. It is 95 feet in length, 50 feet in height at each end, with a lead-in of 20 feet.

Ans.—(1) The natural wave-length of the first described aerial is near to 1,000 meters and the capacity approximately .0017 microfarad. The natural wave-length of the second aerial is approximately 280 meters and the capacity about .0004 microfarad.

We cannot give the possible wave-length adjustments of the first described aerial, because we do not know the dimensions of the receiving tuner with which it is to be used. This antenna is of the correct dimensions for the reception of signals at wave-lengths up to 10,000 meters.

You should have no difficulty in hearing Nauen, Germany, Darien, Isthmus of Panama, and Honolulu, T. H., during the night hours, if you use apparatus like that described in the second edition of the book, "How to Conduct a Radio Club." The complete circuits for an oscillating vacuum valve are given, which will respond to either damped or undamped oscillations at wave-lengths up to 10,000 meters.

Ques.—(2) Is there any law which allows an amateur to use a very long wave-length for his transmitting apparatus?

Ans.—(2) In cases where the amateur experimenter can satisfy the Government authorities that by the operation of his station at wave-lengths in excess of 200 meters, he can in some way benefit the art, particularly if he is conducting a series of experiments, the Department of Commerce will, after consideration, allow a license, but for mere amateur communication along the usual lines, a license for wave-lengths in exces of 200 meters will not be allowed.



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Ques.—(3) At what time and what wave-length does the Illinois Watch Company send the time signals?

Ans.—(3) It is listed in the radio stations of the United States as having irregular hours of operation. The call letters are 9ZS and two wave-lengths of 600 and 2,000 meters are given.

* * *

C. D. L., Nuttallburg, W. Va.:

That you are not able to receive the Arlington time signals with the apparatus you describe may be accounted for by the fact that your station is located in a canyon 1,000 feet below the level of the surrounding country. It is a fact that receiving aerials so disposed are often hindered in the reception of long distance signals. However, with a very sensitive receiving set, such as a vacuum valve amplifier, you should have no difficulty in receiving Arlington time signals in view of the fact that your receiving station is but 255 miles distant from that transmitting station. The natural wave-length of your 80-foot aerial is approximately 238 meters, and, of course, you would secure better results by an aerial of greater dimensions. It may be that your receiving detector is not sensitive or that you are not wholly familiar with its adjustments. It is also possible that the primary winding of your receiving tuner has insufficient values of inductance to raise the wave-length of the antenna circuit to 2,500 meters used by the Arlington station for the transmission of time signals. We are not familiar with the dimensions of the coils in the receiving tuner you describe, but we would suggest that you communicate with the makers direct and ask them if they consider that your antenna has sufficient dimensions for the receiving tuner they have sold you. A receiving tuner particularly suitable for Arlington time signals is described in the second edition of the book, "How to Conduct a Radio Club."

Ques.—(2) Will a fuse block serve the same purpose as a ground wire in protecting my instrument from lightning?

Ans.—(2) No. A fuse will be of no value for lightning discharges, because even if the fuses blew, the succeeding lightning discharge may be of sufficient value to jump the gap in the fuse and injure your apparatus. During a severe lightning storm all transmitting and receiving apparatus should be completely disconnected from the antenna wires and the antenna wires in turn directly connected to a stout copper wire, which is connected to an earth capacity having at least 200 square feet of metal.

* * *

W. G., San Rafael, Cal.:

The information you request concerning the Austin oscillating vacuum valve is given in full in the second edition of the book, "How to Conduct a Radio Club." A circuit of this type is also published in the Proceedings of the Institute of Radio Engineers.

H. V. R., Hollis, L. I., inquires:

Ques.—(1) Is an aerial 125 feet in length, with a 30 foot lead-in, having an average height of 40 feet, too long for operating at the wave-length of 200 meters?

Ans.—(1) It will have a natural wave-length close to 300 meters and, of course, is of excessive value. By attaching the lead-ins near to the center the fundamental wave-length of the aerial will be reduced sufficiently to permit operation at the wave-length of 200 meters.

Ques.—(2) Will it effect the efficiency of the set if the lead-in wires are not brought exactly from the center?

Ans.—(2) No.

Ques.—(3) Can a 1-inch spark coil be connected directly to 110 volt A.C. mains without the use of a step-down transformer if the precaution is taken to screw the vibrator up tight?

Ans.—(3) The primary winding of this coil has an insufficient value of impedence for connection to 110 v. A.C. mains and will undoubtedly burn out, unless an external reactance or resistance coil is employed.

Ques.—(4) Will a lightning switch, mounted on a wood base, give less leakage than one where the clips of the switch are mounted on a slate base?

Ans.—(4) Dry wood is undoubtedly a better insulator for high potentials than slate, but you will find it still better to mount this switch, if possible, on a slab of hard rubber on a plate of glass. Slate is a very inferior material for high potential alternating current.

* * *

T. T. M., inquires:

Ques.—(1) I recently noted in a store window a ½ h. p. water motor, which is to be operated direct from a faucet. Do you think that this will give sufficient power to run a dynamo which in turn is to supply current for an alternating current transformer or an induction coil? If you believe my proposition feasible, what type of generator or dynamo would you consider advisable? I possess a 1-inch spark coil, a 4-inch spark coil and 1 kw. 110-volt 60-cycle transformer. Which of the foregoing should I use? Any information you can give me along the lines of generating home-made current will certainly be appreciated.

Ans.—(1) It is, of course, evident that a ½ h.p. water motor cannot operate a 1 kw. 110-volt 60-cycle transformer; consequently you have to resort to the 1-inch or 4-inch spark coil. For either of these coils you would not require a potential in excess of 18 or 20 volts; therefore you should have some manufacturer quote you on a 250 or 300 watt direct current generator, giving a potential of from 18 to 24 volts. In our opinion the ordinary water motor is a rather unsatisfactory proposition for taking care of the loads imposed by a wireless telegraph set upon a generator. Very cheap gasoline engine generating outfits can be obtained nowadays and you would do well

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to get in touch with the manufacturers of this apparatus. In case you purchase the latter outfit we would recommend that you get one of sufficient capacity to generate ½ kw. 60-cycle alternating current, or, by special design, a 120 or 240-cycle generator could be provided.

* * *

W. A. S., Ridgewood Heights, L. I., inquires:

Ques.—(1) Please state the wave-length of an aerial 40 feet in length and 45 feet in height.

Ans.—(1) Assuming that it has four wires the fundamental wave-length is about 155 meters.

Ques.—(2) Could Arlington and Cape May, N. J., be received on this aerial with a 700-meter tuning coil, a loading coil 12 inches in length, 3 inches in diameter, wound closely with No. 24 green silk covered wire, a crystaloi detector and a pair of 2,000-ohm head telephones shunted by a fixed condenser?

Ans.—(2) The entire apparatus has sufficient value of inductance in the antenna circuit for adjustment to Arlington signals, but a loading coil should also be connected in series with one lead to the receiving detector in order to keep the circuits in resonance, or the two leads extending from the tuner to the receiving detector may be shunted by a small variable condenser. You, of course, understand that it is highly important for best results that the antenna and detector circuits be in exact resonance. This condition you probably cannot obtain in your present apparatus.

Ques.—(3) What process takes place in a loading coil that gives it the quality of inductance?

Ans.—(3) Any electrical conductor possesses the property of inductance because it has the ability to store up energy in magnetic form. When an electric current of varying strength is sent through a coil of wire, owing to the increase and decrease of magnetic lines of force about the wire, a reactive effect is set up in the circuit, causing a tendency to oppose the current which originally produced it. A straight wire possesses inductance as well as a coil, but the effect is greater in a coil of wire because the lines of force are concentrated within a small space and the adjacent turns act directly upon one another. When inductance is placed in a radio frequency circuit it has the effect of increasing the time period of vibration, requiring a greater length of time for a complete oscillation to take place in that circuit.

* * *

L. W. C., Swampscott, Mass., inquires:

Ques.—(1) Attached to this query you will find a diagram of Cohen's new receiving set as employed at some of the stations of the United States Navy. Can any better results be obtained from this circuit than from a receiving transformer of the usual inductively-coupled type?

Ans.—(1) We see no reason whatsoever why the Cohen circuit should give better signals than a receiving transformer of ordinary construction.

Ques.—(2) Referring to my diagram: What are the proper proportions of the coils and the variable condensers if they are wound with No. 20 single cotton covered wire, so that the entire apparatus will be adjustable to wave-lengths of 2,500 or 2,600 meters? This equipment is to be used in connection with a vacuum valve detector.

Ans.—(2) In the first place we do not advise the use of No. 20 wire in connection with a vacuum valve detector. Better results would be obtained with No. 30 S. C. C. wire. If the coils, L1 and L2, are 10 inches in length, 3 inches in diameter, wound with No. 30 S. C. C. wire, they will give good results with the vacuum valve detector.

Ques.—(3) Is the noise made by the arc circuit at the Charlestown Navy Yard, Charlestown, Mass., caused by the towers reradiating energy which is absorbed from the aerial?

Ans.—(3) The irregular sounds heard from this station are undoubtedly due to irregularities in the action of the arc gap which has a slight damping effect on a radiated wave, causing the signals to be audible in the receiving tuner employing an ordinary crystalline detector.

Ques.—(4) What type of detector does the Boston Marconi station use?

Ans.—(4) Cerusite and carborundum crystals are in use.

Ques.—(5) How much power is regularly employed at this station, also at the Cape Hatteras, N. C., station?

Ans.—(5) The Boston station employs a 2 kw. sixty-cycle synchronous spark set. The Hatteras station is equipped with a 2 kw. 240-cycle synchronous spark transmitter.

* * *

J. B., Hyattsville, Md., inquires:

Ques.—(1) Will you kindly advise the type and the dimensions for a condenser and a helix for use with a ⅜-inch Bunnell spark coil. The apparatus to be used at a wave-length of 200 meters.

Ans.—(1) A condenser of exceedingly small capacity is required. Generally a single plate of glass, 8 inches by 8 inches, covered with a sheet of foil 6 inches by 6 inches, the glass being ⅛ of an inch in thickness, will suffice. The oscillation transformer may be 8 inches in diameter composed of 12 or 14 turns of No. 10 wire for the primary winding. The secondary winding may have from 8 to 12 turns for your present aerial.

Ques.—(2) How far can I transmit with this outfit?

Ans.—(2) You should cover from three to five miles under the usual conditions, but probably better results could be obtained by discarding the helix and condenser and connecting the spark gap directly in series with the antenna system.

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H. D., Cape Girardeau, Mo., inquires:

Ques.—(1) A wireless set located in a building which is lighted by a 220-volt direct current generator, in turn run by a reciprocating engine, is bothered by interference from this generator or its feeder. The power house is located 75 yards from the building in which the wireless set is located and the leads thereto are run underground; yet every stroke of the piston of the engine is received as a click in the receiving set, so that when the engine is running a continuous clatter is heard in the wireless. This is very objectionable and often it is impossible to hear anything else except the noise from this generator. It is observed that the generator does not spark at all at the brushes. One of the leads of the generator is grounded and the frame of the machine is also connected to earth. I have permission to make any changes that will not involve too much expense or interfere with the operation of the lighting and power system. Other remedies that I have tried have so far failed. What do you suggest as a possible remedy?

Ans.—(1) You have not stated the type of engine employed. If a gasoline engine with an electric spark ignition system is employed, you would, of course, receive interference from the spark discharge at the spark plug. If a steam engine is used to run this generator, the trouble is very likely due to electrostatic induction from the power leads, and we believe that if careful observation is made of the brushes when they are in operation it will be found that a slight sparking does take place which sets up the induced currents in the wireless telegraph aerial. You, of course, understand that there must be a variation of the current from this generator in order to set up the disturbance.

The effect may be corrected to some extent by connecting condensers of 2 microfarads capacity across the power mains and in turn connecting the center lead (the lead between the two condensers) to the earth. Also, particular care should be taken to connect the conduit in which the power wires are laid to moist earth. You might also try connecting condensers of large capacity across the brushes of the armature. For example: Two condensers may be connected across series in a set of brushes and the center point connected to the frame of the machine. It may be possible in this manner to absorb a considerable amount of the counter electromotive force of the windings and thereby prevent them from affecting the wireless telegraph aerial. You have a difficult problem on your hands and in some cases it cannot be solved.

Ques.—(2) Will you please explain the fading out of wireless telegraph signals, particularly in a case where the effect is more noticeable from an amateur station than from a commercial station. What is the known or the probable cause and what steps can be taken that will minimize this objectionable phenomenon?

Ans.—(2) The subject is rather too comprehensive to be completely covered in this department, but freely we may state that the fading of radio signals is not clearly understood. So many factors are involved in the case that a study must be made of the given station to determine the probable cause. Usually this phenomenon is observed when the receiving station is outside the daylight of the transmitting station. Under these conditions a wide variation of signals is observed and is supposed to be caused by the reflection of the conducting surface of the space represented at a distance of about 15 to 40 miles above the surface of the earth. It is assumed that, owing to the absence of air, this space is more or less of a conductor and consequently has the property of reflecting wireless telegraph waves emanating from radio stations located in the earth proper. It is possible that this reflecting medium changes its position with conditions of daylight or darkness and perhaps is not constant throughout a consecutive hour, causing the signals to go up and down at a given station accordingly.

The fading of signals is often due to an improperly designed transmitter; one which is leaking at some portion of the apparatus. It is also sometimes caused by heating of the spark gap electrodes and frequently has been found to be due to leakage of the antenna current over the high potential insulators. At the receiving station the fading of signals may often be accounted for by irregular action of the receiving detector itself, which does not remain in adjustment for any distinct period. For example: A crystalline detector will lose its sensitiveness if damp air is allowed to blow over it. The subject of the daylight and night effect is fairly well described and discussed in the Proceedings of the Institute of Radio Engineers, copies of which can be purchased from the Secretary, at No. 111 Broadway, New York.

Regarding your query in reference to the refraction and reflection of ether waves: You would do well to study thoroughly the early experiments of Hertz in this respect; you will find the reports of his researches rather comprehensive. It is possible to reflect, refract and diffract either waves of wireless telegraphy as well as those of light. In fact, ether waves of all lengths are subject to reflection, refraction, diffraction and absorption, and bodies that are opaque to the passages of light waves will permit the free passage of the long electric waves used in wireless telegraphy.

* * *

A. C. B., Canton, Ohio:

A diagram of the balanced crystal system, as used by the Marconi Company, is given in the "Text Book on Wireless Telegraphy," by Rupert Stanley. These crystals are not connected thus to prevent interference, but to eliminate the effects of atmospheric electricity.

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# National Amateur Wireless Association

## OFFICERS OF THE ASSOCIATION.

PRESIDENT, Guglielmo Marconi.

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Lieut.-Col. Samuel Reber, Signal Officer, U. S. Army.

E. E. Bucher, Instructing Engineer, Marconi Wireless Telegraph Company.

ADMINISTRATIVE OFFICERS:

ACTING PRESIDENT,
J. Andrew White,
Editor, THE WIRELESS AGE.

MANAGING SECRETARY,
Clayton E. Clayton,
450 4th Avenue, New York.

A national organization of wireless amateurs was announced in the October, 1915, number of THE WIRELESS AGE. Further details of the organization are given in an address made by J. Andrew White, which was published in the November WIRELESS AGE. Reprint copies sent upon request.

## MEMBERS' EQUIPMENT.

**1st. CERTIFICATE OF MEMBERSHIP.**

The handsomely steel-engraved Certificate, with shadow background half-tone, is sealed and signed by Officers, with the endorsement of Senatore Marconi, as President. Every member will want to frame and place it alongside of his Government License certificate, two documents establishing status as wireless amateurs.

**2nd. AERIAL PENNANT.**

The 36 inch aerial pennant, painted in four colors on scarlet felt, will stand long service at your aerial mast head. Every member will be proud of the National Insignia flying from his aerial.

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**3rd. MEMBERSHIP PIN.**

The National Amateur Wireless Association Pin in gold and enamel is the National emblem of the Association. The design shown on the preceding page can but faintly describe its handsome appearance in three colors and gold. The pin has a special patented hub and shank which permits it being securely fastened on the coat lapel or on the vest without turning upside down.

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It is intended to make the monthly bulletin service for members of the National Amateur Wireless Association one of the most important features of the Association. This bulletin is to be used in connection with "List of Radio Stations of the World" described above. It will carry all additions (both amateur and commercial) to "List of Radio Stations of the U. S.", issued by the Bureau of Navigation, U. S. Department of Commerce, and secured for members at 18c a copy. The Government list is issued only once a year. The Association Bulletin will keep both lists up to date for you month by month, and in addition, will carry other special and invaluable Association features not obtainable elsewhere

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THE WIRELESS AGE is the Official Organ of the National Amateur Wireless Association and will contain full reports of wireless amateur activities, both national and local. It is planned to give published recognition to individual amateur achievement.

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Those who, *during the past six months,* have become subscribers to THE WIRELESS AGE, or have renewed their subscription, or have purchased any portion of the Membership Equipment, may consider such payment as partial payment of Membership Application as given below. If you have paid for a subscription to THE WIRELESS AGE which includes books which are not a part of the Membership Equipment, then you may credit $1.25 of the remittance as partial payment on the Membership. For example, you may have remitted $2.25 for the combination offer of the 1915 Year Book with one year's subscription to THE WIRELESS AGE. In this combination, the price of both the book and the subscription was reduced, to make the special offer; therefore, you may be credited only with that part of the payment which went to the magazine—that is, $1.25. *Coupon subscribers receive no credit for trial orders.* Subscribers to THE WIRELESS AGE who *began or renewed more than six months ago,* will secure through Membership dues a renewal for another year; and their subscriptions will be extended for one year from the time the present subscription expires.

## INITIATION FEE

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**SPECIAL NOTICE REGARDING CORRESPONDENCE.**

**As the National Amateur Wireless Association is in no sense a money making enterprise, and as the nominal dues will cover a very small amount of handling expense, it is desired that the correspondence be limited to only the most essential necessities.** A cordial invitation is extended to all club officials to write on matters pertaining to organization. This invitation also includes those who are interested in starting new clubs.

**Charters**—Out of the amount paid by each member for annual dues, it is purposed to allow organizations that have become part of the National Amateur Wireless Association a rebate of 50 cents out of each $3.00 for their own treasury—a fund to take care of local expenses. Please note that this is a rebate, not a deduction. In order to qualify for recognition as a unit in the National Amateur Wireless Association, a club must have at least five active members and at least one-quarter of its total membership become members of the National Amateur Wireless Association. Clubs securing a charter will have representation in the National Council; this means that they elect their own delegate and thus secure a voice in the management of the Association and in the planning of its future development and activities.

**Clayton E. Clayton, Managing Secretary,**
**450 4th Ave., New York.**

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**Checks and money orders should be made payable to: Natl. Amateur Wireless Assn.**

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CLAYTON E. CLAYTON, Managing Secretary,

NATIONAL AMATEUR WIRELESS ASSOCIATION, Date.....

450 4th Avenue, New York City.

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Reference.....

Reference.....

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4—Are you now a subscriber to THE WIRELESS AGE?.....

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# National Amateur Wireless Association

A DIRECTING ORGANIZATION DEDICATED TO THE PROMOTION OF RADIO COMMUNICATION

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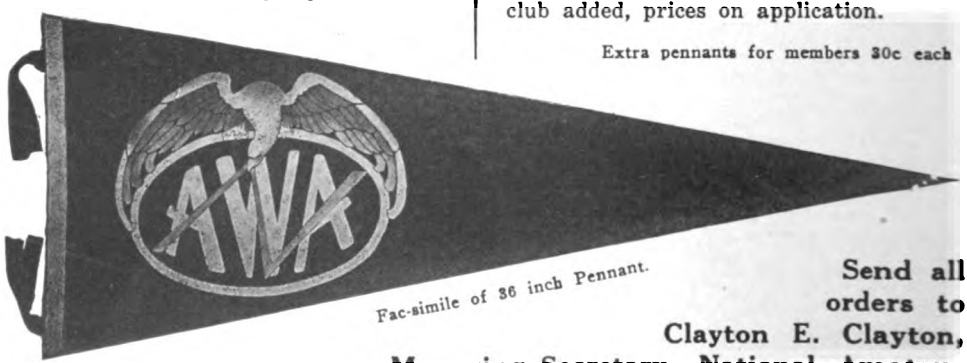


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# THE WIRELESS AGE

Owing to the fact that certain statements and expressions of opinion from correspondents and others appearing in these columns from time to time may be found to be the subject of controversy in scientific circles and in the courts, either now or in the future, and to sometimes involve questions of priority of invention and the comparative merits of apparatus employed in wireless signaling, the owners and publishers of this magazine positively and emphatically disclaim any privity or responsibility for any statements of opinion or partisan expressions if such should at any time appear herein.

SEPTEMBER, 1916

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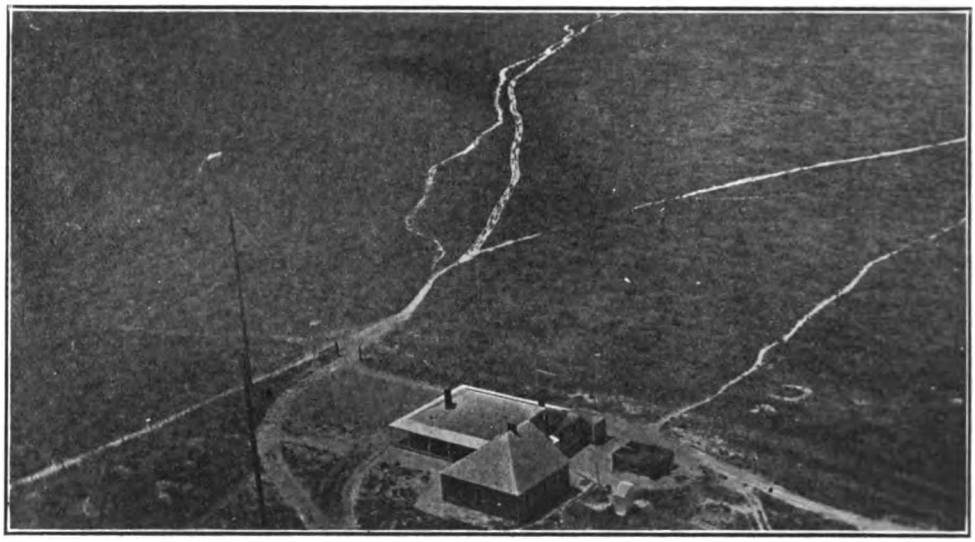

*A birdseye view of the operators' dwelling and annex. This photograph was taken from one of the wireless towers*

# Where Wireless History Was Made

## The South Wellfleet Station Which Marconi Used to Conduct Early Trans-Atlantic Experiments

**By Irving Vermilya, Manager of the Station**

RISING high above the sand dunes of a bluff overlooking the Atlantic Ocean, sixteen miles from the tip of Cape Cod, are the towers and masts of WCC—the Marconi station at South Wellfleet, Mass.—which, from the historical wireless viewpoint, has more than ordinary interest. For it was known at the time it was built as the only high-power station in this country. Moreover it was this station that Guglielmo Marconi used to conduct some of his early trans-Atlantic experiments.

South Wellfleet is a part of Wellfleet, which in years gone by was known as a thriving fishing town. Oyster dredging has now taken the place of fishing, however, although the community numbers among its residents many seafaring folk who talk interestingly of the times when big catches were made. In those days sections of the Atlantic Ocean and Cape Cod Bay adjacent to South Wellfleet were dotted with fishermen's craft of various kinds, the streets of the village reflecting the activities on the waters. Today South Wellfleet does not lack life nor interest, but they are of a different variety. During the summer months the village is able to boast of more than 1,000 inhabitants, while in the winter its entire population does not total more than one hundred. This wide variance is due to the fact that South Wellfleet has considerable attraction as a resort.

The wireless station and the dwelling of the operators are about three-quarters of a mile from South Wellfleet, the village being reached by a walk through picturesque woods. The newly-arrived wireless man at the station will find much to interest him in South Wellfleet and the neighborhood. And when he has tired of walking through the woods and wandering about the thoroughfares of South Wellfleet he can, if he chooses, go "clamming," or, when the tide is not too strong or the water too rough, bathe in the ocean in front of the station; if fa-



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vorable conditions do not prevail on the ocean front he has the choice of swimming in the bay.

*Irving Vermilya, author of this article, dressed to weather a storm*

Strikingly different from summer conditions are those in which the operator lives in the winter. For when the icy blasts sweep across the Cape and the snow falls and accumulates in great drifts, he remains during the greater part of the time at his set or in his living quarters.

A winter's night at South Wellfleet with a storm raging is described as thrilling indeed. The wind whistles through the aerial wires with terrific force, producing unearthly sounds without number, and the boom of the surf on the beach is like that of cannon. The violence of the storms can be determined by the experience of a Marconi man who left his quarters one night in the midst of a gale which was accompanied by a heavy snow fall. He had gone only a short distance from the bungalow when he became lost in the storm, and was compelled to walk blindly about the fence-enclosed station property for thirty minutes before he succeeded in making his way back to his quarters. However, the long winter evenings with the resultant opportunities for reading compensate for discomforts.

All the conveniences of a modern dwelling are provided in the bungalow and annex built for the station men's home. The bungalow is one story in height with an attic, and is divided into a parlor, bed room, manager's office, dining room, kitchen and bath room. The annex contains six bed rooms. Running water and electric lights are among the advantages of the quarters.

Chief among the objects of interest in the bungalow is the bed which was occupied by Mr. Marconi while he was conducting his experiments. A newspaper man, detailed by his editor to send the first wireless message across the Atlantic, who was at South Wellfleet at the time of the tests, has told an interesting story of what took place.

"There was a wait of a week or more at Wellfleet for Marconi to get the apparatus adjusted to trans-Atlantic work," he said. "One evening, after supper, Marconi telephoned: 'Can you come over right away?'

"It was a particularly dark night and the wind was blowing across the Cape at about forty miles an hour. 'We shall get it across tonight,' said Marconi. 'The instruments are very well adjusted and we got a signal across to the other side a little while ago. We have been receiving their signals for two or three days. I think that some time between now and midnight I shall be able to get that message out for you.'

*The operators' home viewed from the front, showing the verandas*

"It did not take us long to draft a dispatch addressed to the editor of the London Times congratulating him and the English people on this new bond of communication between the great English-speaking nations, and signed William R. Hearst. It was arranged that I should be in the post-office all the rest of the evening, where Marconi promised to call me up as soon as he had the news I was waiting for. It seemed like hours before the telephone bell rang. Marconi himself was on the wire, so jubilant and excited he could hardly speak.

" 'I have just got your message across,' he said. 'The President wanted to send

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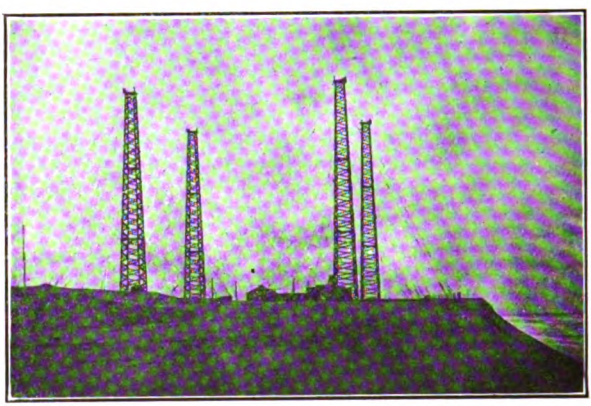
a message to King Edward. We sent that and Mr. Hearst's message and got a return signal that they had been received. Mr. Hearst's message was sent the longest distance a wireless message has ever been (transmitted at that time), for the President's message was picked up by our station at Cape Race and relayed from there, while Mr. Hearst's went directly across the ocean.'"

The beach adjacent to the station which Mr. Marconi employed to such good advantage, is approximately one hundred feet in length, and a short distance from the edge of the cliff stand the four towers. Each is 210 feet in height. There are also two masts. The wireless plant is housed in a large building divided into several large rooms. The spark room contains the condenser which is made up of eighty tanks, the rotary spark gap, oscillation transformer, various choke coils and a large solenoid key.



*South Wellfleet's tall towers, which can be seen far out at sea. The station buildings are also pictured in this photograph*

Adjoining is the operating room. A thick sound proof door with a glass window in it to enable the rotary to be seen while in operation, separates the two rooms. In the operating room is the perforater, on which all press and messages are punched on a paper tape, and the automatic transmitter through which the tape runs, thereby operating the key.

The work shop, which is about fifty feet away from the operating room, can be reached by means of a hall. Here are tools of various kinds and also two lathes, propelled by an electric motor.

In the engine room, which adjoins the workshop, is a fifty-horse-power engine used to drive a large alternator which supplies current for the 40 k. w. transformer. A small seven horse-power engine drives a direct current dynamo to supply the storage batteries and the field circuit of the large alternator.

The rotary spark gap is quite large as compared with the average gap. It is operated by a five horse-power electric motor, the disc, which is three feet in diameter, turning over rapidly. A strong air blast directed on the spark keeps the latter from arcing across the points of the rotary. The side discs also are movable and consist of two solid metal wheels, turned by two small motors.

South Wellfleet differs from the operation of apparatus in the majority of stations, in that the key breaks the secondary circuit instead of the primary, the latter being kept closed. The key which breaks the secondary current has two large spaces between the contacts, the first named piece of apparatus swinging about one inch and three-quarters. This gives the circuit an opening of more than three inches when the key is opened. A 50 k. w. secondary current of course would leap across this space but for the fact that there is an air blast on each side of the key at the openings. This air blast will sometimes carry the flame from the secondary current six to eight inches away from the contact points.

From the station, which has a transmitting range of 1,500 miles, are flashed to steamships at sea, every night at ten o'clock, bulletins containing news of the day. It is also employed to transmit messages to vessels which are beyond the range of the average coast stations.

How well the station has stood the test of time, the stress of storm and the wear of operation, can be judged from the fact that although it was built approximately sixteen years ago, the principal parts of the equipment installed at the time it was erected are still in use.

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# The Désilets Wireless Organ

## A Simple Apparatus for Transmitting Music By Radio

THE Rev. Georges Désilets, of Nicolet, Quebec, is the inventor of an apparatus for producing musical notes in wireless receivers. It operates on the principle of the rotary spark gap, the note of which, it is well understood, depends mainly upon the number of sparks made per second. In the simplest form of the Désilets apparatus, eight rotary spark gaps emitting notes corresponding to the musical octave are mounted on a single shaft, which is revolved by a motor. The current is switched through one or more of the gaps by means of an arrangement like a piano key-board.

The inventor writes that his music has been heard by trans-Atlantic liners in the St. Lawrence River and by the Marconi stations at Montreal, Three Rivers, and Quebec. At present, however, his set is silenced by the war regulations.

A more complete understanding of the Désilets apparatus may be gained from the accompanying drawings and the explanation of them. Ordinary wireless sending and receiving apparatus is employed, except that in place of the ordinary sending key, a plurality of keys are employed, the operation of any one of which will cause a certain musical note to be transmitted, different notes being obtained according to which key is operated. The various musical notes are obtained through the medium of annular rows of rotating spark gaps, each row producing sparks of greater or less frequency than the adjacent rows. A most convenient way of obtaining this result is to provide the annular rows of spark gaps in the form of points or studs projecting radially from the surface of a conical or frusto-conical rotor, the points in one row being the same distance apart as the points in any other row. Thus, the points in the row of greatest diameter would be more in number and would travel at a greater speed than the points in the row of smallest diameter and produce sparks with greater rapidity. In order to produce a regular scale of musical sounds the number of points on each row is determinated by the following relation between the number of points in two adjacent rows well known in acoustics:

1, 9/8, 5/4, 4/3, 3/2, 5/3, 15/8, 2.

The invention will be better understood with the aid of the accompanying drawings in which—

Figure 1 illustrates a diagrammatic view of the apparatus. Fig. 2 a diagrammatic perspective view of one of the operating keys and Fig. 3 an end view of the rotor. Fig. 4 illustrates the diagrammatic view of a modification of the apparatus. Fig. 5 illustrates a diagrammatic view of the regulators for producing pianissimo, fortissimo, etc.

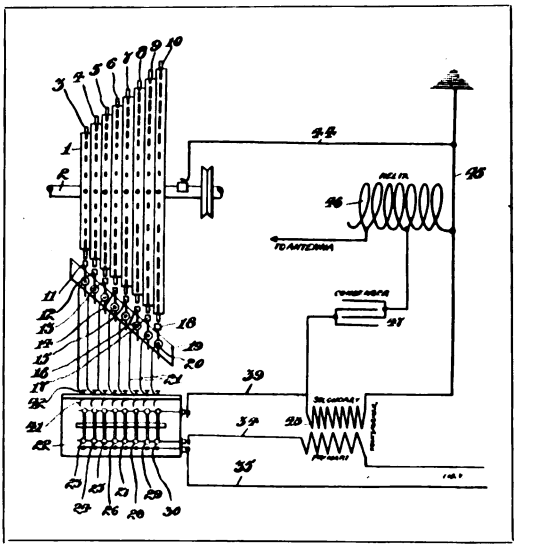

*Fig. 1*

Referring to the drawings, which, of course, do not show the receiving apparatus, which is the same as any ordinary



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outfit, 1 indicates a rotor in frusto-conical shape supported on a shaft, 2, rotated by an electric motor. The rotor is here shown as provided with eight annular rows of radially projecting points 3, 4, 5, 6, 7, 8, 9, and 10 corresponding in number to the natural notes in an octave, though it must be understood that the rotor could be of such length as to include more than one octave, but in order

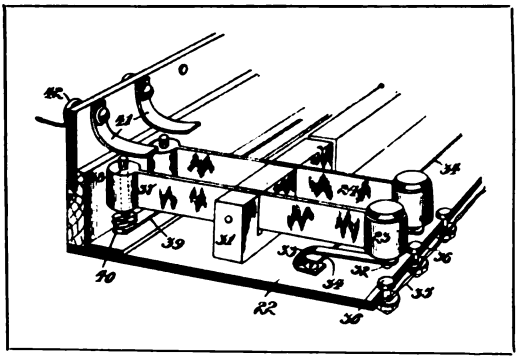

*Fig. 2*

to keep down the size of the apparatus, it is preferred to provide the semitones and additional octaves in the manner hereinafter described.

The points belonging to each of the annular rows and the different rows before mentioned are electrically connected to each other and to the shaft 2. Further, the points of one row are the same distance apart as the points on the other rows and as an example, it may be mentioned for purposes of comparison that if the row 3 contains twenty-four points, the row 4 contains twenty-seven, the row 5 thirty, the row 6 thirty-two, the row 7 thirty-six, the row 8 forty, the row 9 forty-five and the row 10 forty-eight, according to the relation before mentioned.

The points form poles and operate in conjunction with a plurality of fixed poles 11, 12, 13, 14, 15, 16, 17 and 18, one for each row of spark gaps and carried by a suitable insulator 19 provided with terminals 20 to which, and the fixed poles, are connected electric wires 21 leading from the key board 22.

The key board, 22, comprises a set of keys 23, 24, 25, 26, 27, 28, 29 and 30, each of which is pivoted intermediately to a fixed wooden bar, 31. The underside of the outer end of each key carries a contact, 32, electrically connected by means such as the spring, 3, to one of the wires, 34, of the line circuit and the other wire, 35, of the line circuit being provided with a contact, 36, beneath each key adapted to co-operate with the contact, 32, to close the line circuit. Both ends of a key are insulated from each other by the joining arm made of suitable insulating material.

The outer end, 37, of each key is provided with a contact, 38, at its upper end, which is also connected, beneath the key to one of the high tension wires, 39, by means of the spring, 40. Forty-one are spring contacts insulated from each other, respectively extending from terminals 42 to which the wires 21 are connected. All the contacts, 38, are normally away from the contacts 41 and, in pressing a key, the contacts are adapted to be closed just a little before the contact, 32, of the other end of the key touches the contact, 36. Thus, the high tension contacts are closed before the low tension and opened after the opening of the low tension contacts, which prevents sparking at the high tension contacts.

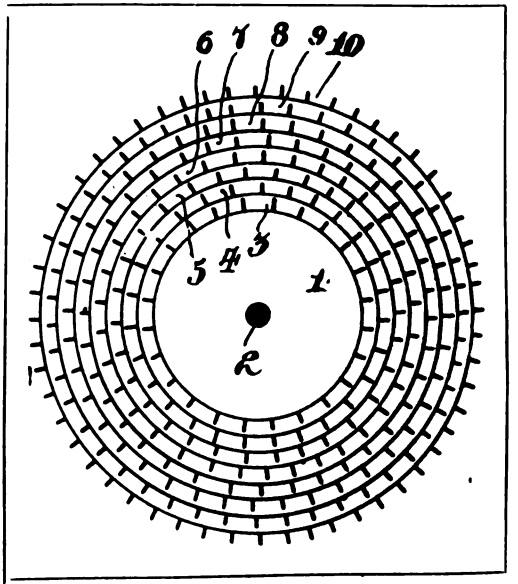


*Fig. 3*

The wire, 34, is connected with the primary coil of a transformer, 43, while the wire, 39, supported by an insulator is connected to the secondary coil of the transformer. The shaft, 2, is also connected by a wire 44 to the ground wire, 45, of the ordinary wireless outfit while the usual

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helix 46 (an oscillation transformer may also be used) and condenser 47 are employed, the former being connected with an antenna in the usual manner.

It will thus be seen that a series of sparks can be obtained at any one of the fixed poles, 18, by reason of the closure of the high tension circuit consequent upon the pressure of the key corresponding to that particular fixed pole and, as before explained, musical notes will be produced by the difference in the frequency of formation of the various series of sparks.

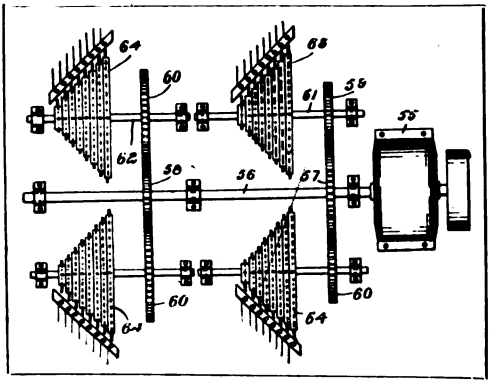


*Fig. 4*

Obviously, in order to produce chords, it is only necessary to supply a current of sufficient intensity to permit different sets of sparks at the same time, consequent upon the pressure of the corresponding number of keys. Further, regulation in the volume of sound for producing pianissimo, fortissimo and similar effects can be provided for by the inclusion of a rheostat in the primary circuit which may be regulated by the foot illustrated in Fig. 5 in which 48 is a foot push-button having the stub, 49, which comes in contact when the push-button is pressed downward with the contacts, 50 and 51, is a wire connected at one end to one of the contacts and at the other end to a rheostat, 52, which is connected to a wire, 53, leading from the rheostat and connected in series with the primary of a transformer.

Fifty-four, is a wire connected to the other contact and at its other end in series with the primary of a transformer.

In order to produce an octave higher, the preferable form is to use an exactly similar rotor and revolve it at twice the speed of the rotor, 1, and similarly an octave lower could be produced by rotating a similar rotor at half the speed of the rotor, 1. The semitones are obtained by a set of rows exactly corresponding to the rows 27, 30, 36, 40 and 45 traveling at a rate of speed 1/20 less than the rotor 1. For example, if the rotor, 1, is revolving at 500 r. p. m., the semitone rows must revolve at 475 r. p. m. The different speeds of rotation may be obtained by gearing and, of course, there will always be a fixed pole and key for each row and similar to those already described. This modification is illustrated in Fig. 4 showing a motor, 55, rotating shaft 56, which is secured to the driving gears, 57 and 58.

Fifty-nine and 60 are spur gears mounted on the shafts, 61 and 62 and 63 and 64 are the rotors, these being similar in construction to the rotor, 1, illustrated in Fig. 1.

It will be noticed that the gear, 60, is of larger diameter than the gear, 59, and that

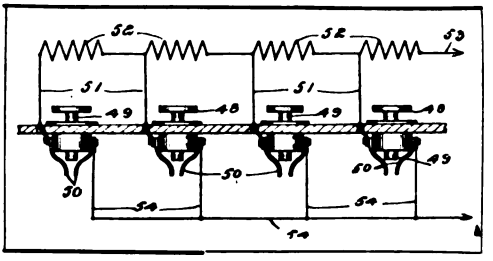


*Fig. 5*

the gear, 58, is of smaller diameter than the gear, 57. It will, therefore, be readily understood that the rotor, 63, will be driven at a higher speed than the rotor, 64, the result being that the rotor, 64, will be of an octave lower than the rotor 63.

Speaking of the apparatus, the inventor remarked: "This system is quite simple, and may be operated with any sending station using a transformer. Moreover, it can be constructed with any number of notes and of any size to suit the power of a particular station. I have a home-made working model playing thirteen notes on one rotor: do, mi, sol, la, si, do, ré, mi, fa, sol, la, si, do.

"Those who have heard it agree that it is real music. Chords are produced by pressing two or three keys, and if the feeding transformer can supply the nec-

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essary power we have surprising results and pleasant effects. Obviously, a more elaborate machine, constructed on the lines suggested, would given even better effects.

"Unhappily, my station was closed last year on account of the war, and my organ is now silent. I hope to resume my experiments later on; meanwhile, I wish I could, for a time, live on the free soil of the United States, paradise of the wireless amateur."

Canadian and United States patents on the invention have been issued to the Rev. Mr. Désilets, who stated: "I must say that I am indebted to THE WIRELESS AGE for many hints in my wireless experiments."

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# The Written Radiogram

## A French Professor's Novel Experiment

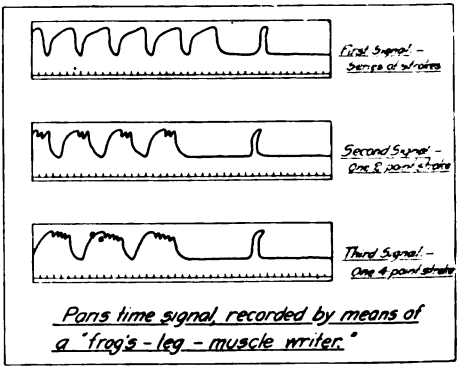
IS it possible to write a wireless message in script? How may it be done? What will it look like?

These problems were propounded by a Frenchman, Dr. Lefeuvre, professor of physiology in Rennes, who found the solution by adopting the method based upon Galvani's well known frog's-leg experiments far back in 1791, which led to the important experiments and discoveries of Volta.

Dr. Lefeuvre's frog's-leg transcriber is based on the principle that, if the movement of a muscle is stimulated through an electrical current, a contraction of the muscle ensues. He attached to the frog's leg a pointer, or needle, moving on a tiny axle, and which was held in a definite position by means of a weight. The needle was thus enabled to record, with every muscular contraction, a distinctly visible sign, which was automatically reproduced on a rotary drum.

The professor was successful in applying this principle of "muscle-writing" in a highly interesting way to the reproduction of radiograms in the script or cursive form of writing. The signals he transcribed were the Paris time signals, which are reproduced in the accompanying drawing. These reproductions give the best evidence to the theory that, in the automatic recording of time-signals by wireless, only an instrument, slow in movement and of low activity can be utilized.

Dr. Lefeuvre states that in spite of the fact that the muscle responds to the




Paris time signal, recorded by means of a "frog's-leg-muscle writer."

electrical stimulus with a rapidity of scarcely one-hundredth of a second, it accelerates the motion of the needle so as wholly to obscure the time period of the individual signal drawings.

This method of transcribing wireless messages, while it has no practical value, is nevertheless regarded as highly interesting as a laboratory experiment. The results are taken as proof of the drawbacks attending the use of the mirror galvanometer in the automatic recording of time signals, namely high inertia and overperiodical damping. In this respect it is reasoned that a movable system is not enabled to follow the individual impulses and there occurs no record of the individual spark transmissions, as takes place by means of the "muscle-writer."

However, Dr. Lefeuvre has shown us how a wireless message looks in script, and that is interesting, even though it be only the record of a Paris time signal written by a frog.

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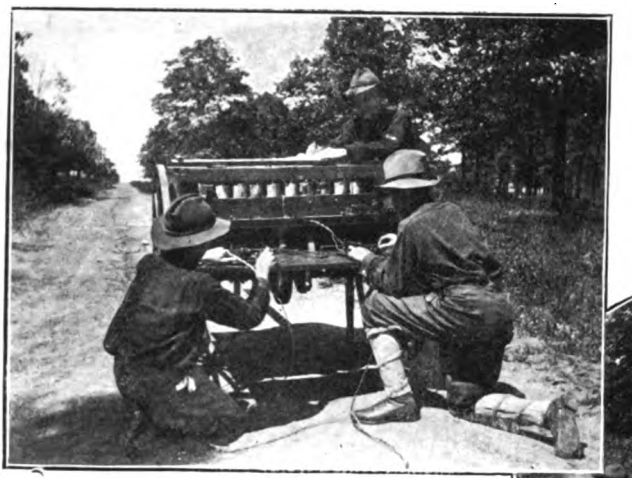

*Members of the Signal Corps Regiment of the New York Division of the United Boys' Brigade of America operating a field wireless station*

## ANOTHER MOVEMENT FOR PREPAREDNESS

With the idea of mobilizing the wireless and signal enthusiasts of Brooklyn, Queens and Nassau Counties in the State of New York, Colonel T. C. Halbert, of Lynbrook, has organized the Signal Corps Regiment of the New York Division of the United Boys' Brigades of America. It is essentially a union of the companies of the various local churches with a present membership of 250, including companies in Brooklyn, Valley Stream, Lynbrook and Freeport, while additional companies are being planned in Brooklyn, Rockville Center, East Rockaway and Rosedale.

Besides individual stations of amateur members, the regiment has equipment consisting of field wireless, telephone and buzzer carts and the necessary equipment of flags for wigwag and semaphore signaling. In addition the members are uniformed in regulation style.

The wireless division is under the charge of Lieutenant Norman E. Cowper, of Lynbrook. At prearranged times signals and military messages are exchanged between stations, a system which will teach the requirements of military work much better than the usual inconsequential talk that amateurs generally send through the air. A line of these stations is planned from Freeport and Hempstead to Brooklyn. Alternating with social meetings of the various units, are others where lectures and special work on army wireless fill the program. Enlistments of amateurs qualified either to teach telegraphy or to become active members in the line are of course always welcome and the prospects for advancement in this branch of the "service of communication" are excellent. Colonel Halbert is building up an organization that will be of much use in a time of national need.

## BLIND FRENCH SOLDIERS FOR OPERATORS

It is an established fact that the blind far excel in acuteness of hearing and sensitiveness of touch their fellow men who have unimpaired sight. The French, with their usual foresight, have taken this into consideration, in planning occupations for French soldiers after the war, according to a recent news report. French scientists after careful investigation, have decided that blind soldiers will make good wireless operators.

The qualities most needed by a wireless operator are highly developed faculties of touch and hearing. In most cases, people who have been rendered blind not only retain those two faculties intact, but develop them to a remarkable degree of acuteness and sensitiveness.


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# What of the Sealers?

## How Wireless Answers This Question When Peril Overshadows the Ice Fields

By C. S. CARTER

"WHAT of the sealing fleet? Are the men and ships safe?"

This is the question that is on hundreds of lips when storms sweep the Newfoundland coast. For at such times many stories of men lost on the ice or of vessels jammed to wreckage between the floes come to the minds of the families and friends of the seal hunters. In years gone by the question was asked in vain and there followed weeks of anxious waiting and worry which could not be relieved perhaps until the arrival in port of some vessel from the ice fields.

*Part of the day's work*

Wireless telegraphy has been the means of alleviating much of this apprehension consequent upon a sealing voyage. From day to day the newspapers of St. Johns publish wireless messages from the ships telling of the positions of the latter, the progress of the seal catching and any untoward events, so that the members of the families of the humblest members of the crews can be as well informed as those of the captains of the vessels. The commanders of the sealers also have the advantage of receiving storm warnings by marconigram, thereby being enabled to prepare a considerable time in advance for the protection of their men and ships.

In calling attention to these facts I have in mind a voyage of the Florizel and the other vessels of the fleet which accompanied her to the ice fields. No great disaster occurred on this cruise. It was not uneventful, however, and the folk on land were kept well informed of what occurred.

I was wireless operator on the Forizel, one of the fleet of eight sealers composed of the Eagle, Neptune, Samuel Blandford, Terra Nova, Sable I., Bloodhound and Erik, when she steamed away from St. Johns at four o'clock one morning in March, bound for the sealing patches off the upper Atlantic coast of Newfoundland. For two days we proceeded without incident of consequence, and at the end of that time we found ourselves fairly in the ice fields—jammed tight in fact between the floes. There was only one way to free the vessel and that was by the use of blasting powder, the latter being placed in cans and set under the ice. Once clear of the floes, we resumed our voyage and reached a sealing patch one evening a few days later.

Following closely after the Florizel on her cruise was the Erik. So when the men from our ship tumbled over the sides on the ice, eager for the hunt, they found the Erik's crew also making ready for the kill. There was no little rivalry be-



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tween the members of the two crews and this doubtless accounts for the fact

*An old hood family just killed*

*Hauling a seal on the floe*

that the Florizel's men brought 500 seals aboard the ship before the night's work was ended.

A series of articles published in previous numbers of THE WIRELESS AGE described in detail the work and excitement incidental to catching seals, so I shall not attempt to narrate the particulars of how we made our kill. It is enough to say that at the end of three weeks we had some 37,000 seals on board and the owners of the vessel, upon receiving a wireless report of what had

*Scalping one of the catch*

been accomplished, ordered us to return to St. Johns.

In the meantime the families and friends of the men on the Florizel, and the other ships of the fleet had been told by wireless of events in the ice fields. The following messages published in the newspapers of St. Johns illustrate the manner in which this was accomplished:

"Florizel—Stormy day, men have panned (killed) today 7,500 seals—total stowage, 24,000."

"Via Fogo—Cable I., Eagle, Bloodhound, Erik, Neptune, Florizel, Samuel Blandford, report their crews aboard and well."

"Eagle—Total on board today, 21,000; weather dull; blowing a gale from the S. E.; all well."

"Viking—Twenty miles W. by N. By-

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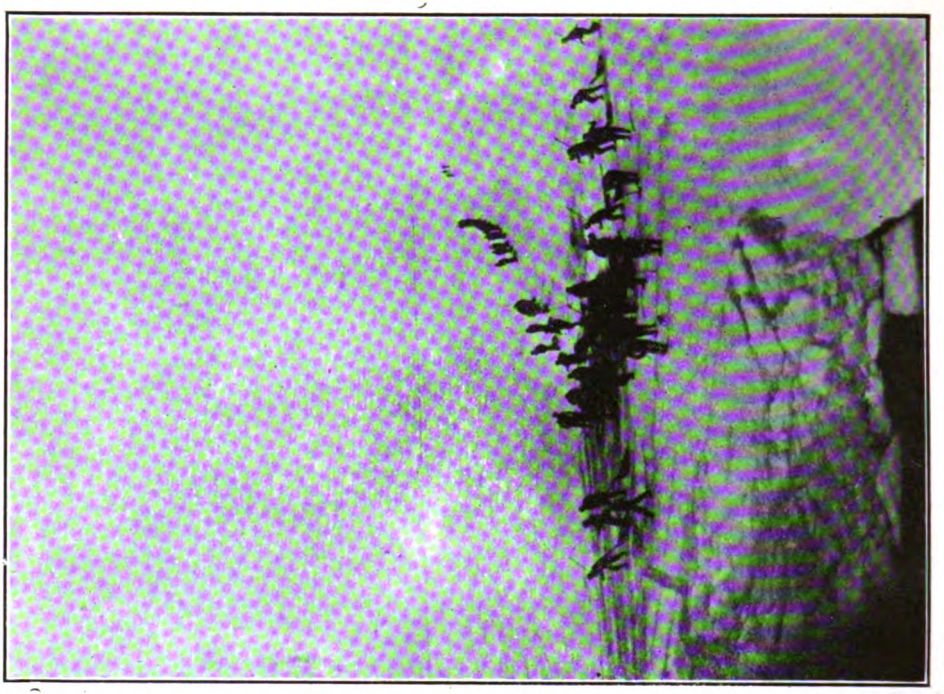
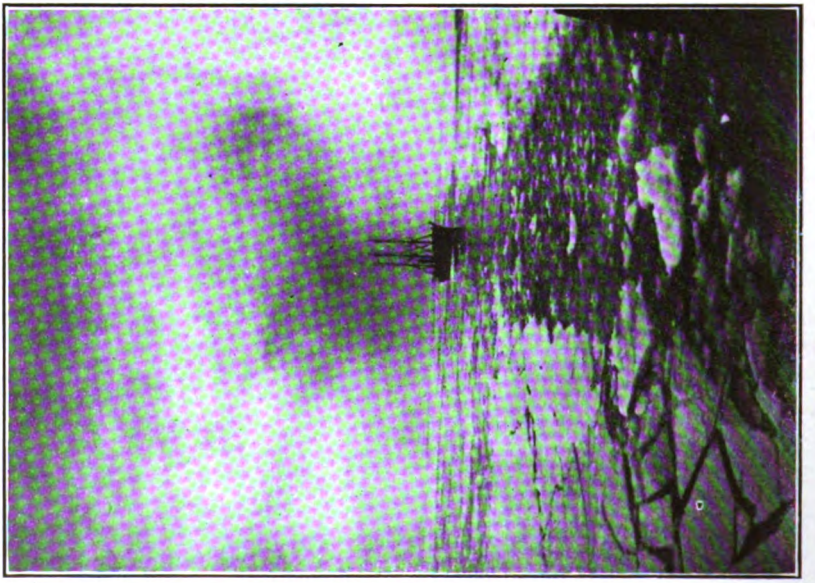


*Making ready to load the seals*



*The Erik following in the wake of the Florizel*

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:on Island, blowing a gale from E. N. E., snowing hard at intervals; too thick to see far; now in patch; whitecoats (young seals), are larger size. Ranger, Diana and Seal here."

"Terra Nova—Fifty miles S. E. by E. Groasis Islands; on board and stowed down, 14,000."

"Neptune—21,000 on board; bad storm with E. S. E. wind and rain; ice very tight."

Following these reports came this message from Cape Ray, signed Marconi station, containing a hint of peril:

"Viking, Ranger and Seal all well, no men on ice. Diana reports ship badly squeezed and ice rafting heavily. Have ordered all other ships to stand by."

A later message said: "Diana reports still in heavily rafted ice, but considers danger over for the present. Other three sealers stood by all night to render assistance if needed. — Marconi Station."

Another chapter of the fleet's cruise is related in these reports:

"Eagle — Blowing a gale from the eastward; ice tight; ship jammed.

"Terra Nova—Position seventy miles S. E. half E. Northern Groasis Islands; 1,000 today; working ahead; ice very heavy; prospects good.

"Florizel—Very stormy day; hard getting along; total stowed, 15,700; 3,000 on deck; 50 flags still on the ice; all well."

"Ranger—Fifteen miles W. N. W. of Byron Island; ice tight; ship jammed; tight ice as far as can be seen; Diana, Seal and Viking in sight.

Came this reassuring wireless from the Diana a short time after she had been reported in danger:

*The Florizel jammed in the ice*

"Think ship O. K., prospects not bright as jammed in heavy; coming home loaded."

There is a marked contrast between the conditions which the sealers work under today and those which prevailed before wireless came into use. In telling of a voyage made to the Newfoundland ice fields in 1862, a sealer said:

"After leaving St. Johns I succeeded in getting out through all the ice and kept beating to windward. When I was three miles north of Partridge Point in White Bay, I took the ice with a heavy wind and a tremendous sea running. The ice was so heavy that one fully expected to lose the vessel during the night. I have seen some six or eight go down the last few days among which are the Emily Tobin, the Melrose and the Margaret, besides several others I cannot name. While I am writing there is so much sea and the ice is so heavy that I cannot tell the moment the sides of my own vessel will be driven in."

Many letter of this kind telling of peril to ships were doubtless written only to be carried beneath the waters with the vessels on which they were penned, and if they did reach the hands for which they were intended it was probably, in no few instances, due to chance. No longer, however, does the element of luck or circumstances have to be taken into consideration in getting word of distress to land, for the radio provides a sure and infallible means of conveying appeals for aid, despite the difficulties and barriers which the Far North places in the way. So has wireless revolutionized conditions in the ice fields and bettered the lot of the men who visit them.

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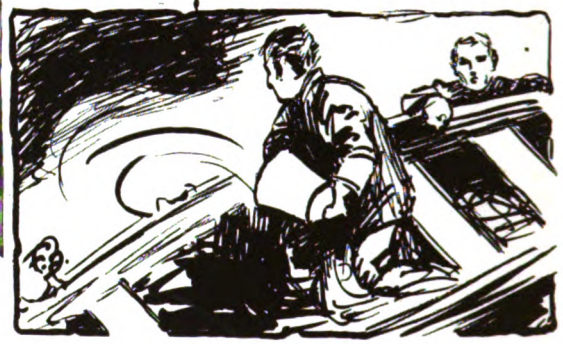
# When the Ramos Went Down

## An Account of a Ship Wreck and a Perilous Cruise in a Small Boat

By Ray Green, Operator on the Ramos

*Operator Green, one of the central figures in the adventure he describes*



WHEN the Ramos steamed away from Philadelphia on July 8 bound for Cartagena, Columbia, it did not occur to me that I was beginning the most adventurous voyage which I had ever taken, for the Ramos looked substantial and seaworthy enough to withstand seas kicked up by a good-sized tornado. And staunch she undoubtedly was, although she could not stand up under the pounding which she received. But that is going in advance of my story. To start at the beginning:

The voyage proceeded without incident for three days, when we struck a heavy nor'east gale with high seas and a barometer that the mate said had no bottom. The waters drove the members of the crew out of the quarters in the forecastle, and my room being one of the two dry cabins on board, the first assistant engineer and the bo'sn took shake-downs on the floor. The seas continued to run high and at about nine o'clock that night the pressure-guage on the boiler burst. The engineer left the cabin to investigate, returning in an hour to tell the bo'sun to nail an awning over the bunker hatches, which were leaking badly. Soon the engineer sent up word that he was having trouble controlling the leak, and I went on deck to see the situation myself. The gale was roaring in an alarming way; big, black seas would rise slowly till they appeared like a range of hills, dark against the storm clouds, then topple over at the crest in an ugly white swirl that immersed the forecastle.

The engineer reported at three o'clock in the morning that he could not handle the leak and soon after, the captain handed me this message to be flashed broadcast: "S O S Ramos 310 miles north one-quarter west Watling Island sinking."

I immediately began to operate the set, but in the middle of the message a terrific sea struck the steamer, smashing in the window of my cabin and drenching



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the apparatus. I worked like mad to dry off the water and fan away the dampness and when the damage had apparently been remedied I called Miami, a station I could hear working some ship. While I was flashing the signals, the captain came to the cabin with word to change the position of the ship to latitude 29.25, longitude 75.19, "heading southwest by south at five miles per hour."

Meanwhile, the engine had stopped and the crew set to work on the launching of a lifeboat. I had been sending an appeal almost without interruption and finally I received an answer, the response coming from the Van Hagendorp. She broadcasted our message and the Miami then responded asking the captain of the Ramos if he wanted to communicate with New York, but the suggestion was declined. The tanker Illinois and another tanker, both of which were distant about 130 miles, wirelessed that they were racing to our aid. A few minutes the Van Hagendorp signalled again.

"KER," she called, "we are 100 miles south, coming full speed, reach you about 3 P. M."

I replied by asking her to send us her position every hour.

The Ramos was now filling rapidly, and it was decided to lower the lee lifeboat. But when it was hauled up at the falls, the roll of the steamer swung it wide and sent it crashing back against the side of the wireless cabin. After several attempts, however, it was lowered into the water.

With a life-belt adjusted below my shoulders and a coil of rope tied about my waist, I stood waiting orders when the captain came along. He was holding to the boat-deck rail, for the Ramos was rolling heavily in the trough of the seas. He made some inquiries and then informed me that "you have done your duty and you may go."

That was the last I ever saw of him.

I went on deck, and from the windward lifeboat someone called to me to jump in, although there were twenty men aboard already. Just then the steamer rolled, first to leeward then to windward again taking a great swell and dumping it into the lifeboat which immediately turned over. Some of the men jumped for the steamer rail and others down into the sea, I being among the latter.

When I came to the surface the capsized lifeboat was above me, so I climbed under the seats and remained there for several minutes, lashing myself to a thwart with a rope. Suddenly the boat turned upright again, for the chief engineer had tried to crawl on top of it. The men on the Ramos saw me and shouted.

I threw out the seine-floats for the chief engineer and the others to hold on to, and began to bail vigorously, my efforts being accelerated by the knowledge that a school of sharks was nearby. As the boat gradually righted four of the men climbed aboard; some had gotten on the steamer, others—two of them—had been dragged down by the sharks.

Then began our cruise over the seas through the darkness in a small boat in search of a rescue vessel. At midnight the gale was blowing with terrific force, but the men at the oars managed to hold the bow of the boat head on to the seas. At dawn they were still pulling tirelessly at the oars. They would watch big white-caps as they curled over the top of a wave and came roaring down the long slope, wait, dip their oars deep, and pull with steady force till the crest passed under us. Then we would race down the side and look up the front of another wall of water. I tried to take an oar but a wave hit it and knocked me over backwards into the boat, so I was made steersman. Half a mile away we could see the Ramos, rolling water-logged in the trough of the waves. Suddenly her bow heaved slowly up showing the red painted bottom, a cloud of coal-dust puffed upward as the pressure of the air blew off the hatch-covers, and she slid stern first underneath the waters and disappeared.

We hunted for provisions, but the water keg and all our supplies, except a loaf of wet bread and a bottle of pickles, had been lost when the lifeboat rolled over. One of the men rigged a sail from a piece of canvas some four feet square, which he tied to an oar. We unlashed the compass, divided the day into

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watches of three hours on, and three off, and laid our course toward Charleston, 350 miles away, on a route that would carry us across the paths of coastwise steamers. Soon the sun appeared and at the same time the gale moderated slightly. With the increased warmth, however, came thirst, which made the men dip their hands in the sea water to moisten their mouths. Hunger added to the hardship and by five in the evening we were all eyeing that loaf of bread and bottle of pickles with the utmost interest.

Sunset was at hand when we sighted smoke in the distance. As we mounted the crest of a roller, we saw a black-painted steamer with gray upperworks, ploughing through the waves toward us. When we were within 500 feet of the vessel, however, she swung around and steamed away at full speed on a zig-zag course, apparently mistaking us for a submarine. Presently it was suggested that we dine. The idea was approved, and never did I taste anything more delicious than that salty bread, dried out in the sun on a seat, and one water-soaked pickle.

It was my trick at the tiller again after "dinner" and while the others slept, I sat propped up in the moonlight, guiding the boat between the crests of the huge waves, all the time fearfully watching the big sharks that played about us. One, larger than the rest, swam within ten feet of me and rolled over showing his white belly and wicked V-shaped mouth.

About three in the morning, another man took the tiller, and I fell asleep. Suddenly the shout, "A light!" brought me scrambling to my feet. We all gazed intently out over the seas, and when the boat mounted the crest of a wave, the lights of a steamer were plainly visible, read ahead. Our last red Coston light was brought into play, and the men pulled vigorously at the oars while I shrilled on the bo'un's whistle. All this was not without its effect for the vessel stopped and waited for us. As we pulled under her stern we saw one of our lifeboats near her bow. We learned later that it had left the Ramos nine hours after we set out and had been drifting about near us.

The steamer that picked us up was the Jose. Once on board, we learned from the occupants of the other lifeboat that the captain of the Ramos, the mate and five men who had taken to our third boat were missing. The Van Hogendorp was sighted soon after we reached the Jose and the latter, which is without wireless equipment, signalled by flag that the Ramos had sunk and that a boat was adrift. The Van Hogendorf searched for thirty hours without success, and the tanker Illinois also scoured the seas in vain.

The Ramos' men were taken to port by the Jose, all being thankful enough to set foot on land once more. Such is the story of the wreck. For me it held not a little of hardship and danger, but it was an experience not without benefit, for it has been truly said that it is only the unknown circumstances inspire fear. Therefore, I feel that I should be able to face any perils born of the sea unflinchingly.

## WILD ANIMALS FED BY WIRELESS

Probably no form of communication created by human ingenuity has been put to such a variety of uses as wireless telegraphy. The most novel use on record, however, was the feeding of a sea menagerie by means of the radio service.

One day a radio message reached Philadelphia from the British steamship West Point, bound to that port from London, with a cargo of starving and fighting wild animals. The message stated that the supply of food for a large consignment of bears, deer, wolves, lions, monkeys and other animals on board had been exhausted several days before, and that the hungry animals were at that time fighting amongst themselves. The consignment was intended for the Brooklyn Zoological Gardens. The message stated that the ship expected to arrive in Delaware Breakwater that night. A fast tug was at once loaded with fresh meat and started to meet the West Point early the next morning.

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# The U. S. Signal Corps Stations

## The Equipment at Fort Sam, Houston and the Radial Counterpoise at Fairbanks

THE United States Signal Corps has installed ten radio stations in Alaska, varying in size from 1 k.w. at Petersburg, Wrangell and Kotlik to 10 k.w. at Fort Gibbon, Nulato and Nome. Stations of from 3 to 5 k.w. have been installed at St. Michaels, Circle, Fairbanks and Fort Egbert.

In the Philippines stations have been installed at Manila, Fort McKinley and Fort Wint, and a station of 10 k.w. at Corregidor.

In the United States a 1 or 2 k.w. set has been installed in several of the Coast Artillery districts; 3 k.w. sets at Fort Wood, Fort Omaha and Fort Riley, and a 10 k.w. set is to be installed at Fort Leavenworth. Sets of from 1 to 5 k.w. have been placed on fourteen transports and three cable ships, and sets of from one-eighth to 2 k.w. on the harbor boats consigned to Coast Artillery districts that have a shore station.

All the Alaska and the Philippine stations, except Corregidor, have their generators driven by gasoline engines. The generators in the artillery districts and on the harbor boats are nearly all driven by motors from local electric power. The Fort Wood station may be operated either from a gasoline engine or the local electric light plant. The Fort Omaha, Fort Riley and Fort Leavenworth sets are operated directly from city power.

Two types of portable field sets have been issued by the Signal Corps. The smaller size is furnished to the organized militia, as well as to the field companies. The range of these sets, under normal conditions, is about twenty-five miles over land, but much greater over water. Thus one of the one-eighth k.w. sets, with a 100-foot mast, at Havana has worked with the naval station at Key West, a distance of about 110 miles.

The larger size of field sets is of 2 k.w. output and is carried on a two-chest pintle wagon, one chest with the engine and generator and the other with the transmitting and receiving apparatus. The range of these sets varies from 75 to 800 miles, depending on favorable weather conditions, time of day or night, character of the land between the sets, etc.

The following description of the Fort Sam Houston station is given as an illustration of the type of the 10 k.w. sets installed by the Signal Corps in Alaska and elsewhere in the United States.

Towers: These are of structural steel, about 200 feet high, 28 feet square at base, and 4 feet square at top. The towers are supported on concrete piers, each leg resting on a cribwork of timbers, 12 inches square, painted with insulating compound for preservation and insulation.

Timbers are bolted to the piers and to each other, the bolts from the towers not extending down into the concrete. The towers are about 350 feet apart.

Antenna: The antenna is of the T type, the flat top part of which is composed of four wires, each 475 feet long and 8 feet apart, the wires being carried beyond the towers to backstays.



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Both ends of these wires are insulated with 18-inch electrose insulators. The details of the insulation, spars, bridles, etc., are shown in Fig. 1. The vertical wires reaching from the center of the flat top to the station are each 180 feet long, separated 8 feet, and at the bottom are joined together and carried as a single wire for about ten feet into the station through a porcelain wall insulator.

Counterpoise and Ground: Connections are made to the waterpipe system as a ground, but the most dependence is placed on a counterpoise, which covers about half an acre of land.

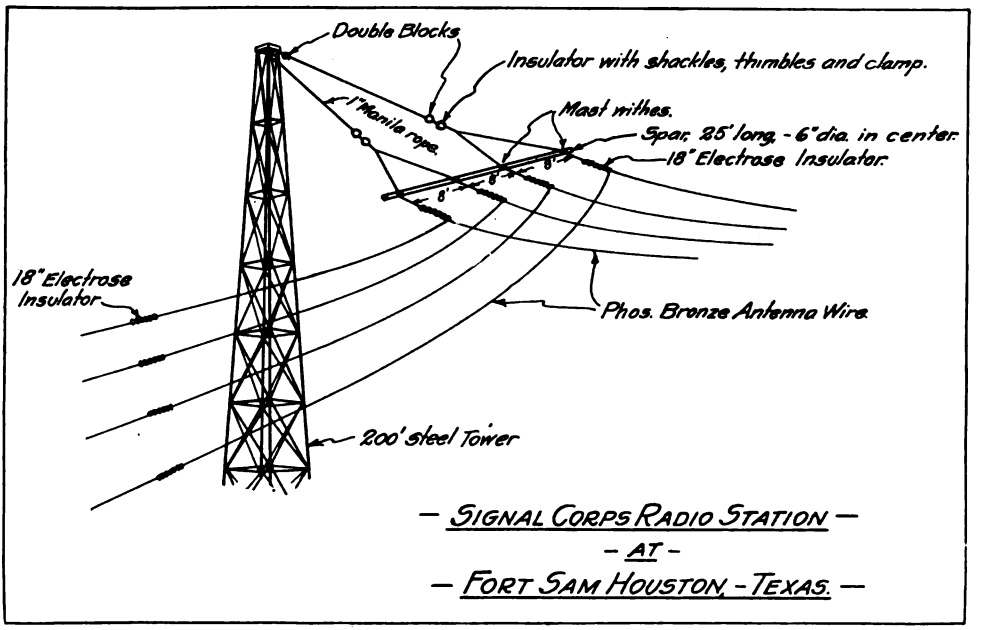


*Fig. 1*

In the permanent stations this consists of a set of bare horizonal radial or parallel wires, which are supported by insulators on posts 7 feet or more above ground. A counterpoise of a fan type has been installed at Fort Sam Houston, Tex., in which bare wires, No. 10, B. & S. gauge, 190 feet long, extend outward from the station under the antenna, being spaced 6 feet apart at the station and 20 feet at the distance ends.

A counterpoise of the radial type has been installed at the Fairbanks (Alaska) station, as shown in Fig. 2, where the wires are bare, hard-drawn copper, No. 12, B. & S., about 210 feet long, and spread out into two arcs, each of ninety degrees. A counterpoise is particularly efficient in case the soil is very dry, as at Fort Sam Houston, and also where there is a heavy snow-fall, as at Fairbanks. At the latter station both a ground and a counterpoise have been installed. In the case of the Signal Corps wagon sets, radial counterpoise wires mounted on temporary poles, carried as a part of the set, were used at first, but these now have been replaced by the same type as that of the pack set, that is, rubber-covered wires, each 100 feet long, laid out radially on the ground. Although not directly connected with the ground at all, these wires really constitute one plate of a condenser, the ground being the other.

Power Equipment: To continue with the description of the Fort Sam Houston station set. The alternator is belted to a single phase sixty-cycle, twenty-horsepower induction motor driven by electric power furnished from San Antonio. The motor can be automatically started by closing a switch on the operator's table. In places where such power is not avail-

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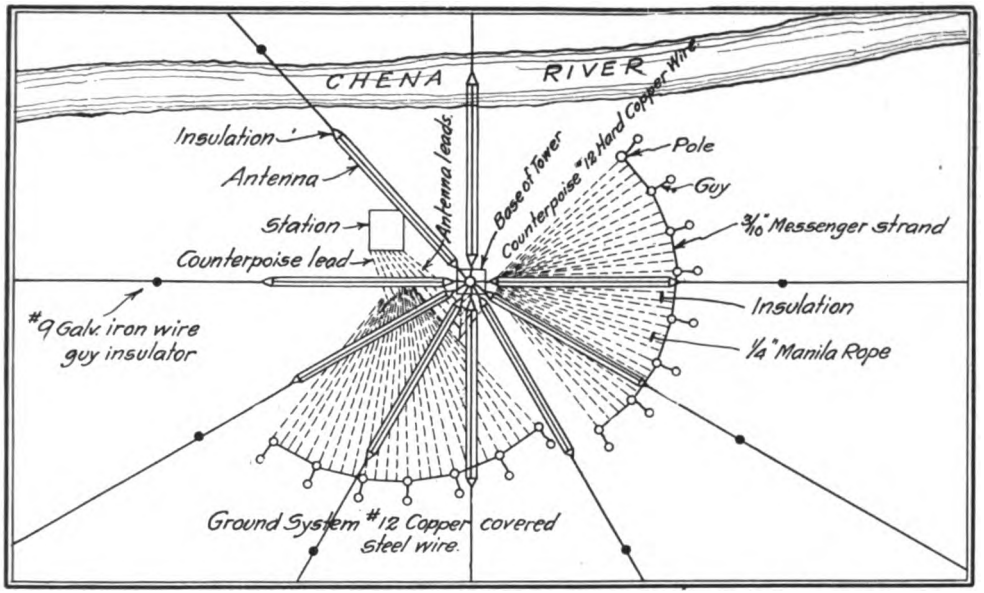


*Fig. 2*

## COUNTERPOISE AT FAIRBANKS (ALASKA) STATION, TO OBVIATE EFFECTS OF HEAVY SNOWFALL.

able, as in Alaska, a Fairbanks Morse twenty-horsepower gasoline engine is generally used. The generator is of the inductor type, separately excited by a 15-k.w., D. C. exciter on the same shafts as the A. C. armature, and delivers the power of 10 k.w. at a frequency of 500 cycles and at 220 volts.

Switchboard: The switchboard is mounted close to the operating table and contains the 500-cycle frequency meter, A. C., ammeter and voltmeter, D. C. ammeter and voltmeter, and generator field rheostat for the adjustment of the alternator voltage. The 500-cycle wattmeter and the antenna hot-wire ammeter are mounted elsewhere.

Transformer: The transformer is of the open magnetic circuit type with dry insulation, with a reactance in its primary circuit for the proper adjustment of these circuits.

Key: The key is of the relay type, controlled by an ordinary Morse key, which uses the direct current from the exciter to operate the relay. The Morse-key contacts are shunted by a condenser to cut down the sparking.

Condenser: The closed-circuit condenser consists of five leyden jars, covered with foil, each of a capacity of 10,000 c.m. or 0.0111 m.f.

Inductance: The closed circuit inductance is in the form of a helix wound with flat strip and adjustable only by steps for certain predetermined wave-lengths, contact being made on the step corresponding to the desired wave-length and the secondary or open circuit tuned to resonance with the closed circuit.

Spark Gap. The gap is of the quenched type with plates of copper, but with a heavy plate of silver for the sparking surface. The separators are of mica. The gap is cooled by a blower driven by an electric motor taking power from the direct current exciter.

Open or radiating circuit: As this set is of the directly connected type, the closed circuit inductance is included in the open circuit. The coupling can be changed by the use of antenna loading

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inductance, variable by steps for approximate resonance and an antenna variometer for fine adjustment between these steps.

Receiving set: Two sets have been provided, both being of the inductively-coupled type. In the receiver of the first set, two primary coils are furnished so as to secure a wide range of wave-lengths, and in addition a primary condenser that can be connected by a switch, either in series with the coil for short wave-lengths or in parallel for long ones. Similarly three secondary coils are furnished, one when no secondary condenser is used and the circuit is only broadly tuned and the other to be used with the secondary condenser when the circuit is sharply tuned. The detector with the telephone and the fixed condenser is not permanently connected across the terminals of the secondary condenser or coil as in many circuits but across a variable number of turns in the coil.

The circuits in the receiver of the second set, known as the 1-P-76 set, are similar to those in the other, except that the primary circuit has no condenser and hence cannot be tuned to wave-lengths shorter than the fundamental wave-length of the antenna, unless an extra condenser is provided. For very long wave-lengths a loading inductance, normally not connected in circuit, can be inserted and varied until resonance is obtained. The secondary circuit has a variable coil and condenser, across the terminals of which the detector, etc., is connected. As the perikon detector furnished with this receiver is more sensitive when a small electromotive force is applied to it, a potentiometer is included as part of the set.

The telephones are of the adjustable pole-piece type.

## THE WRECK OF THE MATATUA

Rolling off Cape Race in a wild gale and the worst fog of the season, a tremendous sea crashing over the reefs to port and thundering at the foot of beetling cliffs to starboard; among treacherous currents that had piled up six big steamers in two months, and with 200 seasick passengers below—such was the situation on the Red Cross liner Stephano when the Matatua flashed her S O S through an abnormal static and Marconi Operators C. B. Ellsworth and G. Emberton on the former vessel picked up the wavering call: "Steamship Matatua, beached seven miles S. Saint Mary's light."

It was eight o'clock on the night of July 22, when Ellsworth brought the message to Captain Clifford Smith, of the Stephano and the Red Cross liner was at once swung around and began to feel her way toward the distressed Matatua.

At length she was found, a 6,000-ton steamer flung clean over the outer rocks and stranded a hundred feet above the normal high water mark. At daylight the fog still held. The Matatua had shot a line ashore and taken her people off, but the ship had left her bottom on the reef and her cargo of munitions was mixed with the rocks that the undertow was heaping around her—and piling up at the foot of the overhanging cliffs. So, while the passengers and crew were safe, the ship was beyond Captain Smith's aid. Therefore, he groped his way out to sea again, giving aid on the way to the patrol boat Canada, which was also in distress.

## SURGEON CALLED BY WIRELESS

Another example of the swift aid furnished by wireless has been reported by Operator H. W. Underwood, of the steamship Centralia. While transferring cargo in the harbor of Mazatlan, one of the crew was hit by a sling load of freight and knocked into the hold, sustaining a broken left arm and a serious fracture of the ankle. Underwood immediately called the United States gunboat Annapolis, lying at anchor a short distance away and obtained surgical aid in a few minutes.

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# The Fighting in Tampico

## An Operator's Experiences During a Brisk Fortnight While the Rebels Were Attacking the Mexican City

**By A. G. Berg**

*Operator A. G. Berg of the Mexicano*

THE Waters-Pierce tank-ship Mexicano, Mexican registry, tied up at Tampico on April 17. We had come in from Galveston to take on a cargo of oil for Vera Cruz, and, while sincerely hoping to keep out of trouble, I think everyone on board was prepared to dodge bullets. Thus far Tampico had been spared the worst of the wastage that has ravaged the country for the past six years, as all parties understand that the oil fields surrounding the place are by far the richest prize in the whole game of war and are to be preserved—each hoping to have the loot for themselves.

I had rather expected to see a badly battered city, but as we steamed slowly up the Penuco River, the great oil-tanks and refineries that line the shore showed no visible signs of warfare. The outgoing tide was streaked with oil; here and there tugs were towing storage-barges to their berths and there were a dozen tankers of varied size and conditions of paint filling themselves with oil at the several wharves. Out in midstream lay a dirty, slate-colored Federal gunboat with her guns slewed around at indifferent angles and a grimy awning over her decks. It was disspiritingly hot and muggy, and when the wind shifted around to landward it bore out to us varied odors of oil and other things too Mexican to mention.

The Camaguey, of the Ward Line, lay nearby with Operators Rice and Giles on board. We went ashore to take in the city, which we found a typical low-built, flat-roofed town with many broad plazas. Much of it was rather attractive but parts were unbearable. We had dinner (also a lemonade that made me ill for the next two days) then strolled about the plaza listening to the strains of a very good military band till it was time to go on board again.

Things began to get interesting on April 19, two days after we arrived. The gunboat ordered us to leave dock as the rebels were going to make an attack on the town, and, when the Captain anchored a little astern of the man-o'-war, made him take another position farther away so as to be out of the line of fire. On the same day, the American steam yacht Wakiva was refused clearance on account of her nationality. Her skipper immediately appealed to the captain of a British cruiser then at Tampico, to have the vessel placed under the English flag. This permission was promptly granted and the Wakiva steamed out of



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the river under the nose of the gunboat flaunting from her stern the red ensign of Great Britain.

Two days later I was awakened by the shock of a heavy gun fired close at hand. In a minute I was on deck in my pajamas. The gunboat was cleared for action, with a cloud of smoke pouring out of her funnel and her guns at high elevation pointing out over the city. As I reached the rail she let fly again. We could hear the shell tear out over the flat housetops till it burst in a cloud of black smoke in the fields three or four miles beyond. There, through a bridge telescope, I could see little groups of high hats running forward and now and then spits of fire from the Mausers. Wherever a shell hit, the high hats would scatter like a flock of sparrows. The rebels had no artillery and, considering the average shooting ability of the Mexican, we on board the tanker thanked our stars.

The gunboat steamed slowly about, firing her heavier guns till the rebels gave up the attack as a bad job. The crackle of the rifles died away, the hats disappeared and the gunboat took a rest.

Next day, April 22, the rebels dug up a cannon and came back to give it a try. That made things lively for us as two of their shrapnel whizzed through our rigging and burst with a big bang fifty yards overside. This was entirely too close for the captain's peace of mind, so he hove anchor and hunted a more peaceful berth up-stream.

Meanwhile they were moving a lot faster on board the gunboat than I have ever seen Mexicans travel before or since. Her guns were banging away every minute or two. Once in a while the rebel cannon would drop a shell somewhere in her general neighborhood and blow river-water all over the scenery. Then the gunboat would skitter off like a water-bug and begin to shoot again from her new position. From inshore came heavy bursts of rifle-fire tied together with a pretty steady popping from the snipers, punctuated now and then with a heavy thud when they took a chance with their cannon. On board the Mexicano we spent a lively day.

After dark the firing ceased for the night, and it was quiet during the two days following. On April 25, however, the gunboat sent word over that I would have to get off the ship on account of being an American. I was put ashore by the captain and took my grip over to the Camaguey, which was due to sail before long for New York. They had me spotted, however, for when I was ashore next day with Operator Rice, a Mexican customs officer with a rifle stopped us and abused me on the general grounds that I was a Yankee. We wanted to retaliate, but his rifle did not look very tame and he wouldn't let us get close enough to grab it.

On the three succeeding days there was some sharp-shooting ashore, but nothing very serious. On April 29, however, they went at it again in great style with another gunboat, the Zaragoza, to help the first vessel. The Zaragoza let fly a wild shot that exploded in an oil barge close to the Mexicano and set it on fire. For the next two days it burned with a tremendous cloud of black smoke, and at night the glare of the flames reflected in the water made a striking picture, one, however, which we were in no mood to appreciate.

This was the day that the Ward liner Antilla steamed in with her funnel and ventilators punched full of bullet holes. and her quartermaster shot through both legs below the knees. We learned that the rebels had caught her lower down in the stream and boarded her, expecting to get away with all her supplies. But in the midst of the proceeding one of the two Federal gunboats tore up at thirteen knots an hour in a cloud of smoke and sent them flying for cover.

For the next three days there was nothing doing except a shot once in a while out on the edge of town. It was hotter than ever and smelt worse than I ever imagined possible, even for a Mexican town.

When the Camaguey sailed for New York on the second of May, I was on board, only too glad to get out of Mexico.

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# The Year Book of Wireless Telegraphy, 1916

THE force contained in a pocket full of solar dust "would convey to the earth enough energy to run one of our large battle-cruisers at full speed for eighteen hours!" Such is one of the remarkable conclusions drawn by Dr. Fleming in his article on "Photoelectric Phenomena" in the 1916 Year Book of Wireless Telegraphy and Telephony, published by the Marconi Publishing Company, of 450 Fourth Avenue, New York.

There is an unusal amount of interesting reading matter in the volume. In spite of the "damping" effect of the war, which has shrouded in secrecy the most important developments in the radio field east of the Atlantic, much observation of scientific value has still been continued, and in the United States the establishment of radio-telephone communication between Arlington and Hawaii has marked a monumental advance in the science. This is covered by an article entitled "Radio Telephony in the U. S. A." with a diagram of the circuits that probably were used and an explanation of the utilization of the Fleming valve on telephone lines. Another device adapted directly from wireless telegraphy is Professor Pupin's loading coil.

The report of the committee of the Institute of Radio Engineers on the standardization of wireless terms is a feature of general interest to workers in the field.

For the benefit of the advanced experimenter, Dr. W. H. Eccles has written on the calculation of wave length and illuminated his text with several useful "Abacs." These are scales drawn in such form that to find an unknown quantity it is only necessary to prolong a light pencil line through the diagram from the position of the known quantities on two arms of the scale to the third arm, which is marked with the desired figures. The answer can then be read directly from the scale. As many calculations in the mathematics of wireless require the use of highly complex formulae, this method, simpler in its operation than a slide-rule or log. tables, will appeal instantly to the investigator, who is enabled to get a positive check on his solutions, or to avoid mathematics altogether.

Dr. Fleming's article on "Photoelectric Phenomena," previously referred to, is one that will make as powerful appeal both to the experienced scientist as to the youngest amateur, just beginning his struggle for the mastery of the code. For the savant there is a singularly lucid exposition of a little known and rather obscure field of research that touches not only upon problems of wireless telegraphy, but affects even such fundamental considerations as weather, terrestrial electricity and the geological formation of the planet. For the amateur Dr. Fleming suggests the fascinating possibility of generating electric power direct from the sun in such tremendous quantities that all our present systems of steam and water power will seem but slight advances over the stone age. While millions of kilowatts of energy pour down upon the earth's atmosphere, man laboriously extracts from the rocks such coal and oil as he may, and by a complex and wasteful process recovers for his use a fraction of the stored potentialities. Such a condition will not last forever. Aside from suggesting such tremendous future developments, the article discusses some extremely practical problems of long distance wireless transmission.

The committee on radio-telegraphic investigation of the British Association for the Advancement of Science, under the chairmanship of Sir Oliver Lodge, con-



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tributes an "Analysis of the Records of Strays"—"strays" being the English equivalent of "static"—with special reference to "X storms," or the violent disturbances in the ether that cause so much interference in the radio service. The committee has taken many series of records made at widely separated points and is endeavoring to discover the relation between such phenomena as the aurora, thunder storms, hurricanes, the great cyclonic movement of the atmosphere and static interference in wireless telegraphy. While reliable conclusions can not be reached till several years have been employed in making thorough observations, the work is one that concerns everybody interested in wireless.

An amusing non-technical account of the development of marine signaling in the British navy is offered by the famous correspondent, Archibald Hurd. The beginnings of the science were not fortunate, as is illustrated by an incident from Sir John Barrow's "Life of Lord Howe":

One day a fleet of ships, supposed to be that of the enemy, hove in sight. The signals were resorted to; but . . . somehow or other they were not made so well as when made at leisure. Geary (the Commander-in-Chief of the Channel Fleet) at last grew impatient, and going up to Kempenfelt (the first captain of the Fleet), and laying his hand gently on his shoulder, exclaimed with good-natured earnestness, "Now, my dear Kempy, do, for God's sake, do, my dear Kempy, throw your signals overboard and make that which we all understand, 'Bring the enemy into close action.'"

This incident, Mr. Hurd explains, is typical both of the condition of marine communication at the beginning of the Revolutionary War and the attitude of the senior officers toward those who attempted to relieve the difficulty. At first the hoist system was developed and later the semaphore was brought to a state of efficiency in France where Napoleon was able to flash orders across the country at a speed that compares very favorably with ordinary modern telegraph service.

Col. F. N. Maude, who is already known to readers of previous issues of the Year Book, has contributed an article on the "Allies' Strategy in 1915."

In addition to these special contributions, the volume contains the usual list of ship and shore stations with their call letters and wave lengths, pages of formulæ, explanations of the various time and weather signals, and the great mass of data and useful information which the public has learned to expect in the wireless Year Book. One feature is a specially indexed section covering the wireless laws and regulations of all nations using the system, which means practically every civilized people on earth. Besides the contributions already mentioned there are several others of interest and scientific value, including an account by John L. Hogan, Vice President of the Institute of Radio Engineers, of the "Measurement of Signal Intensity" and Percy W. Harris on "Problems of Interference." As usual the book is profusely illustrated with handsome photographs, and contains 879 pages, bound in buckram. The price is $1.50.

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## Operator Went Down With the Provence II

The following details regarding the heroism of Joseph Huby, the wireless operator on the Provence II, which was struck by a torpedo, have been related by one of the survivors of the wreck: Huby remained at his post until he was drowned. When the torpedo struck the vessel, he sent the S O S and continued to flash the appeal incessantly while the ship remained afloat. The stern of the ship sank into the water and the passengers made their way to the fore part of the ship, which gradually rose out of the water, but Huby continued to operate the set, until the waters engulfed the vessel.

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During the recent disturbances in Ireland the insurgents severed the telegraph wires which resulted in the loss of communication with England except by wireless. It is also related that when a rebel obtained possession of the wireless station at Stephen's Green he employed it to send broadcast the proclamation of an Irish Republic.

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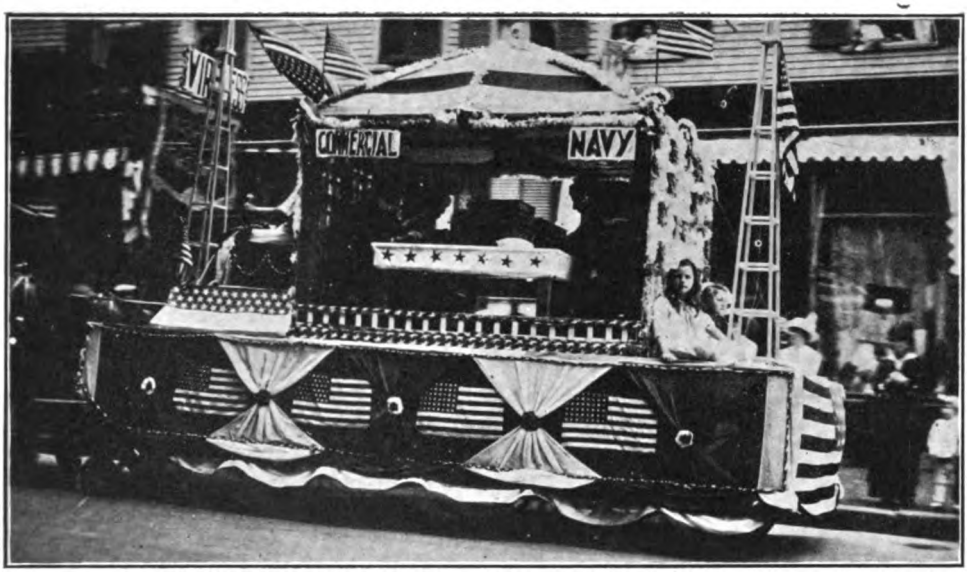


*Floyd Manuel built this float as a wireless exhibit for the Newport, R. I., Preparedness Parade, July 4, 1916*

# With the Amateurs

The Mahoning Valley Radio League has been formed at Niles, Ohio, with a charter membership of eighteen. At a regular weekly meeting the following officers were installed for the coming six months: President J. William Kidd; vice-president, Chas. Thompson; secretary and treasurer, Luther Kovilik.

A special membership fee for members outside a thirty-mile radius of Niles has been arranged for. At a recent meeting of the club an application for membership from Newark, N. J., was considered.

At present the club has only a receiving set, but it expects to obtain a 1 k.w. transmitting set and a supersensitive receiving set soon. A practice table has been provided for student members of the organization. The club wishes to get into communication with other radio organizations.

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The Hawkeye Radio Association, it has been announced, plans to have an excellent exhibit of wireless apparatus at the Iowa State Fair in Des Moines. Several complete modern stations will be shown, including some for the reception of undamped waves.

News reports will be sent to all stations several times during each day, which can be delivered to local newspapers.

The third annual convention of the Hawkeye Radio Association will be held during this time, and several meetings are to be held, all amateurs being invited to attend.

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Material for the new wireless station to be erected on the roof of the Central Y. M. C. A., Albany, N. Y., has arrived. A report on the subject was made at a recent meeting of the members of the Albany Wireless club and it was decided to begin the work of installation as soon as possible. The station wil have two poles, each 20 feet in height. The poles will support four bronze wires each 125 feet in length which will be suspended between the roofs of the two buildings.

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The Amateur Radio Association of



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Buffalo held its first stag outing of the season at Ebenezer recently. A camp site was located at Mill Road.

Amateur wireless operators wishing to affiliate with the Association are requested to communicate with President Carver, Wesker Street, in person or via wireless, call letters 8ED.

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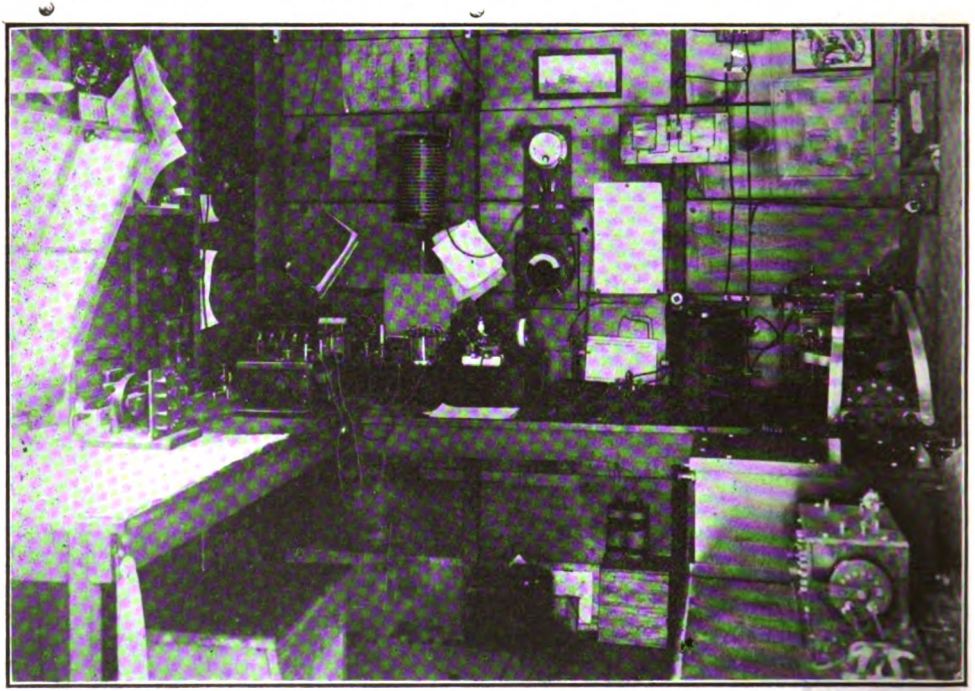
J. G. McCollom of Salt Lake City, Utah, is the owner of the wireless station, a photograph of which appears elsewhere in this issue. It has a 1 k.w. transformer with a sending condenser from 0 to 5 amperes, the other from 0 to 10. The helix coil is used for the antenna inductance, appearing in the picture above the other instruments. For safety, the antenna switch is so arranged that it can be switched from sending to receiving without danger of the sending current getting over into the receiving side.

The receiving set is housed in a cabinet completely enclosing all the apparatus. There is a receiving transformer with dead-end switches capable of tuning up to 2000 meters, equipped



*J. G. McCollom's station at Salt Lake City*

made of sixteen plates of 8 by 10 inch glass and fifteen sheets of 6 by 8 inch copper foil, the whole being set in a zinc-lined tank filled with transformer oil. The oscillation transformer is built of edgewise-wound copper strips, eight turns on the primary and twenty-two on the secondary. For the rotary spark gap there is a hard rubber disk, 5½ inches in diameter with twelve lugs, actuated by a 1/30 h.p. motor turning at from 2000 to 4,400 r.p.m. that gives a very high pitched note. The set has a large sending key and two hot-wire ammeters, one reading with a loading coil and a switch, not shown in the photograph, that will permit tuning up to 6000 meters. There is also a pair of variable condensers, a fixed condenser of small capacity and a one-step amplifier. The vacuum valve detector shown in the picture had to be rearranged. To shift from the valve and amplifier to a perikon detector, shown on the right, there is a double-pole, double-throw switch. The receivers are Brandes 3,200-ohm Improved Navy Standard, connected through to an antenna composed of four silicon-bronze

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stranded wires, 150 feet long and sixty-five feet high, spaced four feet apart. Practically the whole set is home-made.

McCollom receives signals from ships on the Pacific and Pacific coast stations, Panama and Arlington, and transmits 500 miles.

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The Hillsboro Radio Association was organized on October 22, 1915, and then called the Tampa, Fla., Radio Club. For various reasons the name was changed. The officers of the Association are: President, P. H. Wall; vice-president, J. J. Fogarty; secretary, George Warner; treasurer, V. C. McIlvain; assistant secretary and treasurer, Ed Cole; Corresponding secretary, S. L. Boyett. The Association holds its meetings every Monday night at No. 707 Azeele Street, Tampa, Fla. When organized it had only five members, but now we have twenty-seven, two of whom have seen commercial service. The club is now preparing to make and install a club set and this will take up most of the members' time for some weeks.

Address all communications to S. L. Boyett, 1047 Green Street, West Tampa, Fla.

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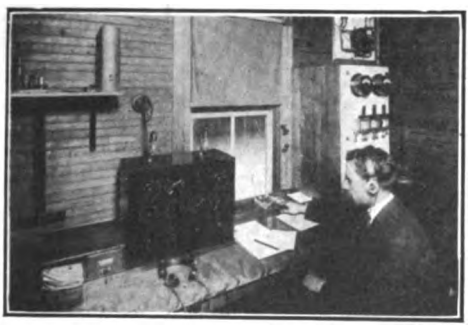
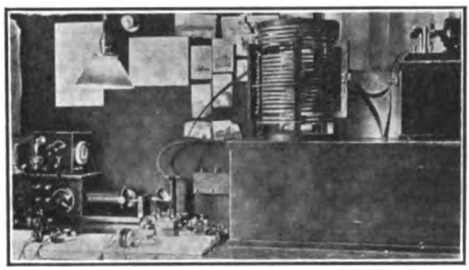
The present membership of the Grape Belt Radio Association includes stations in Erie, Chautauqua and Cattaraugus Counties of New York State only. However, amateurs in Western New York, including counties as far east as Cayuga, Tompkins and Tioga, are eligible for membership, as well as those in Erie, Warren and McKean Counties in Pennsylvania, or in fact, any amateur within the limits of the Second Parcel Post Zone, with Unit No. 1263 as a center.



*G. E. Sabin at the key of IZL*

The present cost of membership is fifty cents, twenty-five of this being the registration fee and the other twenty-five the amount of two assessments, which all new members are required to pay, in order that they may be on equal footing with former members. This entitles them to the loan of the property of the Association, upon payment of any transportation charges to and from the custodian of the property. The "non-participating" members, who do not have the privilege of the use of Association property, are only required to pay a twenty-cent registration fee, without any assessments.



*The well-equipped station of J. N. Grossman*

At present the equipment includes a Clapp-Eastman wave meter and two very good books on wireless. As rapidly as funds become available, through additions to the membership, or by additional assessment if deemed necessary by the directors, other books will be added.

All inquiries will be answered, either by R. H. Lilley, secretary, Eden, N. Y., or Herbert A. Hiller, president of the Association, Lilnes Creek, N. Y.

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The amateurs of Hudson County, N. J., have formed the Hudson City Radio Association, the primary object of the organization being to establish a reliable intercommunicating club or a chain among the members and bring together all amateurs in the vicinity. Amateurs in Hudson County are invited to join the club. Applications should be made to the secretary, Frank V. Bremer, No. 3,613 Boulevard, Jersey City, N. J. Radio clubs in the neighborhood are invited to correspond.

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# What Wireless Means to Railroads

## A Report Presented to the Annual Convention of Railway Telegraph Superintendents

THE advantages of the use of wireless telegraphy by railroads were pointed out in a report presented by the Committee on Wireless of the Association of Railway Telegraph Superintendents to the Association at its annual convention in St. Paul, Minn., June 20-23. The Committee, of which L. B. Foley, superintendent of Telegraph, Delaware, Lackawanna & Western Railroad is chairman, and David Sarnoff, assistant traffic manager of the Marconi Wireless Telegraph Company of America a member, called attention to the fact that different railroads with terminals in the same city can erect an efficient station and jointly share the expense of operating it. The importance of wireless to railroads when wire service is cut off was also pointed out. The report in part follows:

"Since the invention of wireless telegraphy by Marconi in 1897, continued improvements have taken place until now it is admittedly an efficient means of intelligent transmission, capable not only of being utilized as a supplement to existing means of wire communication, but also to provide reliable communication when all other means are unavailable, due to the prostration of pole lines by storm, or for other reasons.

"It was considered a feat when, in 1897, a distance of fourteen miles was covered by Marconi—then experimenting at the Needles station, Alum Bay, Isle of Wight. The American Line s. s. Philadelphia was the first vessel equipped (in 1900), and ship to shore communication was then proven to be possible. Thereafter numerous vessels were equipped with wireless apparatus and the accomplishments of wireless in the marine service are so well-known to all that more than passing mention need not be made of the matter in this paper.

"A new epoch in wireless transmission was marked by the erection of trans-Atlantic stations at Glace Bay, Nova Scotia, and at Clifden, Ireland, which were opened to commercial service in 1907. These stations have been conducting commercial business, in competition with the cables, ever since and at the present time every civilized country is erecting high-power stations for international communication.

"It was not until November 24, 1913, however, that wireless telegraphy received its introduction into the railroad world and the mind of the railroad telegraph superintendent, for it was on that day that the first practical use of wireless was made on trains and between trains and fixed stations, and this practical demonstration, which is now a matter of daily routine, was made on the train and stations of the Delaware, Lackawanna & Western Railroad, which are equipped with Marconi apparatus.

"If there is any doubt in the mind of any one here to-day that wireless telegraphy is not as reliable for the handling of train orders or other commercial railroad work as the ordinary land line Morse telegraphy, that doubt can be promptly dispelled by a trip over the Lackawanna road and an inspection of the radio system now in operation over a distance of 400 miles, with intermediate stations varying from sixty to 200 miles.

"The wireless telegraph serves as an auxiliary means of communication in the event of interruption to wire facilities. There is hardly a railroad in this country which has escaped an entire loss of wire communication on some parts of its line during the past year and during such interruptions almost any amount would be



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cheerfully expended if some means of communication could be found to ascertain the whereabouts of trains and the conditions existing at points entirely cut off from service.

"Early in August of last year wireless telegraphy was the only means of communication with the City of Galveston and other points in Texas during the great tropical storm that swept over the Gulf of Mexico and the southern part of Texas when communication by wire was impossible. The wireless relieved much anxiety and brought prompt relief. Were it not for the wireless the city would have been cut off from the rest of the world.

"The Galveston experience and the Dayton flood of several years ago where wireless also came to the rescue, suggests that every important city in this country should be equipped with a reliable wireless station, capable of efficient communication when, for one reason or another, the wire facilities are interrupted.

"Communication, to a railroad company, is as vital as locomotives and cars. In the east we are visited by sleet storms once or twice a year and sometimes more often. Poles and wires are prostrated; the railroads have difficulty in operating their trains because there is no means of communication available. After each occurrence of this kind we read in the newspapers that some particular railroad intends to spend a million dollars to place its wires underground. The sun shines again, the old service is restored, and the matter is forgotten until the next severe storm comes along. The Pennsylvania Railroad is the only road thus far that has placed its wires underground for telegraph and telephone purposes. This has been done for a distance of about thirty miles in New Jersey. The cost of placing wires underground is far beyond the resources of most roads and is therefore not likely to become universal. Moreover, telegraph engineers do not favor underground construction for many good reasons.

"The Western Union Telegraph Company, with which most of the railroads have agreements, is using shorter poles and a greater number to the mile, guying them in such a maner that they will stay in the ground, but the cross-arms and wires do not stay on the poles during some of the storms and even the modern and expensively constructed lines of the American-Bell Company failed to withstand the storm of March 1st, 1914. It is therefore evident that reliable and comparatively inexpensive communication is required by railroads and the experience of the past few years has demonstrated beyond a doubt that wireless supplies the need.

"Wireless telegraphy is no longer in its experimental state and its cost is by no means prohibitive. Apparatus can be purchased outright by railroad companies and the maintenance and operation thereof is a simple matter. Railroad companies need not go outside of their own organizations to obtain men capable of operating and maintaining the radio equipments; the regular Morse operators can do this work quite satisfactorily. Two stations, fully equipped with wireless apparatus, including towers of sufficient height to work over a distance of 400 miles, cost less than an ordinary locomotive.

"Many telegraph superintendents who have been present at the Association meetings when wireless was discussed, and who have also investigated the question for themselves, have unhesitatingly stated that they are in favor of installing it on their roads but find difficulty in convincing their superiors of the actual need for wireless service; of course this means that no appropriations are forthcoming for the purchase of the necessary equipment, but when viewed in the light of past history, it is but to be expected that new inventions, especially when intended for auxiliary communication, are slow to impress theirimportance on the minds of those who do not come in daily contact with the requirements of the service. Nevertheless, the telegraph superintendent who knows the many troubles which are his during the days when communication is unattainable, should give the matter serious thought and satisfy himself that these troubles can be obviated with the means suggested in this paper. The telegraph superintendent is the first one to be censored

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when wire communication is interrupted; he cannot borrow communication from his neighbors and if the telegraph and telephone companies have any to furnish, the cost is astounding.

"It is not absolutely necessary for each railroad to install towers and wireless equipment along its entire line, especially in territories where one or more roads parallel each other. The different railroads, with terminals in the same city, can erect an efficient station and jointly share the expense of operating it. A few such stations at the more important terminals, operated in this way, would soon convince them of the merits of the system and each railroad could then expand, erecting additional stations along its individual lines, as the service might require.

"A good deal of thought has been devoted to this suggestion by the Wireless Committee, and it was found entirely practicable. Details of the scheme will, of course, have to be worked out in each case, but the wireless company supplying the apparatus will, in conjunction with the railroads, lay out the best plan of communication. If this proposition is approached from the angle suggested, it will afford the advantage claimed for wireless as an auxiliary and at a very small cost to each road.

"Considerable space has been devoted by the newspapers to wireless telephony, and its achievements during the past year justify the belief that wireless telephony will be brought to a state of commercial efficiency before many years have passed; but the accomplishments of the last year have merely demonstrated its principles and possibilities. At the present moment there is not a wireless telephone on the commercial market capable of giving as satisfactory service as the wireless telegraph.

"It must be remembered, too, that if the wireless telephone has any advantages over the wireless telegraph, it will be due to the fact that the telephone can be operated by unskilled persons, whereas the telegraph requires telegraph operators, and until it is perfected to a point where the unskilled person can operate it, it will have no advantages over the telegraph; and up to the present time the wireless telephone has not reached this desired state.

"Wireless telephony, when perfected, will be more applicable to moving trains, especially as it will then not be necessary to employ a special man on trains equipped with the wireless system.

"Having thus reviewed the subject, it can only be said that preparedness is the slogan of the hour; sleet and wind storms are on the way and we should be prepared to defy the elements and maintain communication at all times.

## VESSELS RECENTLY EQUIPPED WITH MARCONI APPARATUS

| Names | Owners | Call Letters |
|---|---|---|
| D. G. Scofield | Standard Oil Co. of California | (Not yet assigned) |
| Balboa | Columbia Maritime Co., Ltd. | (Not yet assigned) |
| Bark Manga Reva | Brynhilda Shipping Corporation | KIP |
| Halcyon (S. Y.) | Dutee W. Flint | KZL |

## THE SHARE MARKET

NEW YORK, August 7.

Trading in Marconi shares was dull on the Curb for practically the whole month, although in London, American Marconi was bid up to 4½ in an active market. Several reasons have been advanced, but the interest in speculative munition stocks, in contrast to investment securities, coupled with the inability to sell American owned stocks in England under the British exchange ruling has kept prices in America lower than normal. English preferred, for example, is quoted 14 bid here and 16½ on the other side. In spite of the dullness the market is strong and, according to those who keep in touch with the situation, gains are to be expected.

Bid and asked quotations today: American, 3⅜—3¾; Canadian, 1¾—2¼; English common, 14—17½; English preferred, 14—16½.

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# Wireless Equipped Balloons

## An Interesting Problem in Military Communication

NOTWITHSTANDING the importance of the wireless-equipped aeroplane in Europe's war, and the achievements of the wireless equipped dirigible, the balloon, both in its captive and free or floating form, is playing a significant role in the great conflict. The captive balloon is used extensively at the front, its position being as a rule directly behind the battle line, but naturally its range of observation is strictly limited. The free or floating balloon is being utilized in siege operations, or in the more thickly populated areas of the war, where observations of enemy positions are made necessary and can be executed best and transmitted best by reason of the peculiar advantages attaching to the wireless stations installed on this form of aircraft.

Many designs have been made for a receiving antenna attached to the free balloon. These have been experimented with exhaustively, and have served not only to establish excellent wireless telegraphic connections, but have been pursued more particularly in the effort to solve special problems connected with the effect of wireless telegraphy on atmospheric electricity. Dr. P. Ludewig has described an antenna form which is reproduced in Fig. 1. This consists of one or more circles of wire strung about the equator of the balloon, whose ends lead to the basket and over the receiving apparatus, the latter being connected with another wire, about 100 meters long, suspended from the basket.

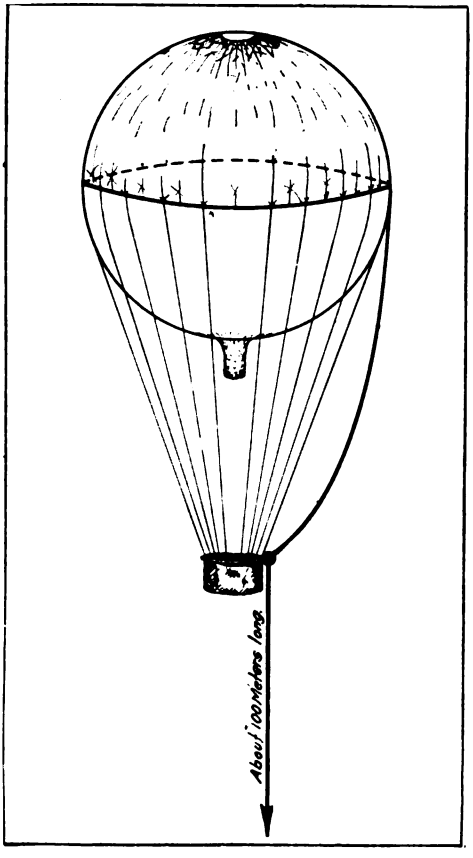


*Fig. 1.—Wireless equipped balloon receiving station*

This form has been used by other experimenters to determine the intensity of the reception in relation to the distance between land-sending stations and balloon-receiving stations; to investigate the dangerous atmospheric disturbances known to wireless telegraphy; to study the spread of electro-magnetic waves of wireless along the sur-



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face of the earth and also to establish proof that under special conditions, a strong decline in receiving intensity may be met with at high altitudes.

This antenna was utilized only for the purpose of receiving. It is evident that the antenna forms of Fig. 1, as favorable as they may be for receiving purposes, are not adapted for the sending of radiograms, since the high tensions created on the wires attached to the body of the balloon would become a great source of danger to the craft and the persons it was transporting. The equipment of the free ball balloon with a sending station is intended for the solution of several interesting problems. An aircraft thus equipped may be sent out from a fortress or fortified city, make its observations over the positions of the enemy and transmit the information from a great distance to the land stations situated in the fortified area.

Another and purely scientific point is being studied by means of the aircraft thus equipped. The modern investigation of wireless telegraphy has shown that the mathematical data compiled on the wireless transmission between sending and receiving stations, are verified only under special conditions. At times in the communication between two stations, strong disturbances and sudden alterations of receiving intensity intervene, in which the dependence of the strength of the receiving current on daytime and night time plays a special role. The cause of these disturbances is not yet satisfactorily explained. At the present time this problem is the center of interest and it is not to be denied offhand by those who are investigating these phenomena, that an important step forward will be taken when wireless receiving and sending stations are made independent of the land.

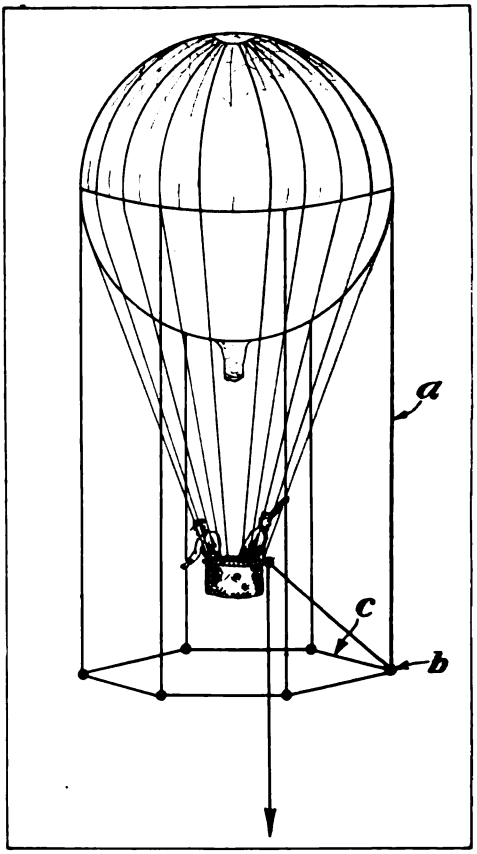


*Fig. 2—Wireless equipped balloon with sending station*

## WIRELESS MEN IN PREPAREDNESS PARADE

Twenty-seven employees of the Marconi Wireless Telegraph Company of America, under the leadership of George J. Jessop, superintendent of the Southern District of the Pacific Coast Division, marched in the preparedness parade in San Francisco on July 22d. The Marconi men marched in the form of a rectangle, well spread out, with the Marconi colors on the outside arm of each line. The San Francisco Radio Club also appeared in the procession.

The explosion which killed six persons and injured many more occured at Steuart and Market streets just after the Marconi men had passed the junction of these thoroughfares. Ellery W. Stone, Government Radio Inspector, who was standing directly across the street from the scene of the explosion, narrowly escaped death, missiles of various kinds falling about him.

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An excellent suggestion has recently appeared in the columns of an English periodical devoted to wireless. It is to the effect that ship operators study Spanish to prepare for the openings that may come in South America.

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# Italy May Use Wireless For U.S. War Reports

THE Italian government is reported to be considering the immediate establishment of an official wireless telegraph news service to the United States. It is to follow the methods adopted by the German semi-official service, the Overseas News Agency.

The motive for installing this Italian service is "to overcome the misinformation and lack of accurate knowledge in foreign countries regarding Italy's war and regarding the admirable attitude of the entire nation, in participating, despite innumerable sacrifices, in the great struggle which the Allies are conducting for the cause of justice and liberty."

Bitter complaint continues to be expressed in the Italian newspapers regarding the falsehoods which have been propagated about Italy, her army and her people, and her method of conducting warfare. The German news agency service is considered as largely responsible for this condition of affairs.

Incidentally it is hinted that in a military way the German officials in charge of the news distribution recently carried out a feat which almost had serious consequences for Italy.

It is being gradually revealed that the momentary success of the Austrian offensive in the Trentino, which resulted in an invasion of a section of Italian territory and a distinct menace against the city of Vicenza, one of the bases for the Italian offensive eastward, was due to clever work by the German disseminators of military news, who succeeded in hoodwinking the Russian army chiefs regarding the nature of the movement of troops which the Austrians were carrying out in the Tyrol, in advance of their onslaught against the Italian forces. The German scheme was to suggest that the Austrian movement in the Tyrol and in the Trentino was simply a realignment of troops, and, above all, that no forces were being moved from the Eastern zone toward the Italian front.

The detail of the whole scheme is declared by Italian military experts to be entirely clear to all at present, and the ingenious way in which allusion was made in the Austrian news bulletins to the movements on the Eastern front of certain divisions and certain regiments and battalions, the numbers and names of which were casually given, whereas these particular divisions had been already secretly moved to the Italian zone, succeeded, the Italians believe, in convincing the Russians that Austria had not designed any serious operation against Italy. The Italian staff, it is hinted, tried in vain to convince the Russians of the true facts and the seriousness of the threatened blow, and of the opportunity afforded to the Russians of hastening their offensive in consequence of the reduction of Austrian forces on the Eastern front.

The Italian government, it is understood, is considering the use of the powerful Marconi wireless stations at Coltano and at Centocelle for the purpose of transmission of news every day to the United States. It is regarded as doubtful, however, if either of these stations can supply the requisite facilities for a full news service such as intended, as they are at present almost constantly kept busy and, at times, they are overwhelmed with important messages.

Guglielmo Marconi himself on April 25 last, which was the forty-second anniversary of his birth, offered to install for the Italian government a new wireless station more powerful than any yet in existence at his own expense. The urgency of putting before the world the true facts regarding the Italian side of the current news was not then appreciated as it is today, nor had the various serious development of the German news propaganda then produced its effect in the Trentino, and Mr. Marconi's offer was taken under consideration by the government.



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It is now suggested that his tender of services for the immediate construction of such a station be accepted, even if his offer personally to defray the expenses be not admitted.

While the German Overseas News Agency service seems intended for America almost exclusively, in reality its chief purpose is now considered to be to confuse the Allies with regard to facts touching the war and with regard to matters which may have military consequences. The news transmitted and addressed to the American stations is promptly caught up by the Eiffel Tower station in Paris and by British stations and is immediately circulated through the countries of the Allies. By the time that the official and semi-official news agencies of the latter countries have consulted the government authorities and have obtained permission to issue contradictions of the German statements a lapse has usually occurred and the German news item is liable to have accomplished its intended purpose before the contradiction is forthcoming. This is one of the defects which the Italians hope to remedy.

## NEW YORK POLICEMEN GRADUATE AS OPERATORS

Sergeant Charles E. Pearce, who is in charge of the wireless branch of the Telegraph Bureau at the headquarters of the New York Police Department, has proved himself an efficient instructor of radiotelegraphy in the conduct of the wireless school for policemen, which was recently established on one of the upper floors of the Headquarters Building of the Department. Six of his pupils, three of them police lieutenants and three patrolmen, have just been made commercial wireless operators of the first class, and are prepared for the novel application of the wireless art to police duty.

In the July number of THE WIRELESS AGE the plans of Commissioner Arthur Woods, to introduce wireless telegraphy into the operation of the Department were described. A large Marconi 1 k.w. 500 cycle quenched spark gap set was installed at Headquarters, an aerial was constructed on the roof of the building, and the wireless school for policemen opened.

Fifteen policemen, including lieutenants and patrolmen, were assigned to attend the wireless telegraphy training school daily for a period of thirty days up to July 30. These men had been carefully selected from among the members of the Department; each one of them was a former railroad, press or commercial telegraph operator. The fact that they retained the knowledge of their former occupation, greatly expedited their instruction in wireless by Sergeant Pearce.

By the end of July, Sergeant Pearce's pupils were ready to take their examinations at the training school for radio instructions at the Brooklyn Navy Yard. Their instruction there continued for nearly two weeks, and the six men passed their examination on July 11 and 12. The successful graduates are Lieutenant John A. Altenbach, of the Atlantic Avenue police station, Brooklyn; Lieutenant George H. Quackenbos, of Police Headquarters; Lieutenant William H. Van Keuren, of the East Twenty-second Street station, and Patrolmen George Wolf, Emil Kopko and George T. Vale. These men have received from the Department of Commerce certificates conferring upon them the title of commercial radio operators of the first class, and all are now eligible for assignment to any wireless station.

Undoubtedly the officials of the police departments of every other large city in the country are watching the innovation of wireless at New York Headquarters with much interest, and it will probably be seen that the first successful application of wireless telegraphy in the detection of crime or criminals, or in the maintenance of order and public safety in some great disturbance or calamity, will cause the introduction of this useful service in the departments of many other cities.

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# How to Conduct a Radio Club

*(Especially Prepared for the National Amateur Wireless Association.)*

## Receiving Detectors for Wireless Telegraphy

### ARTICLE XXVII

*(Specially Prepared for the National Amateur Wireless Association)*

**By Elmer E. Bucher**

PERHAPS the most interesting types of receiving detectors in use at present are the variously constructed vacuum valves, the forerunner being the Fleming Valve, which is shown diagrammatically in Fig. 16. A tungsten or

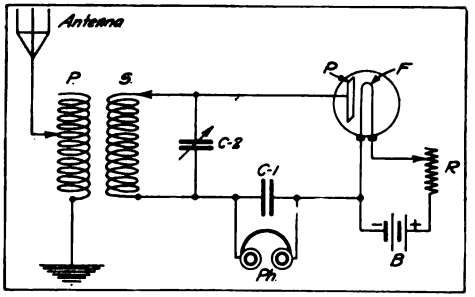


*Fig. 16*

carbon filament F is sealed in a glass bulb with a copper or nickel plate P, the bulb being exhausted to a high degree. The filament is brought to incandescence by the battery B, which may be of 4 volts or 12 volts. The incandescence of the filament is controlled by the rheostat R, which usually represents a resistance of about 10 ohms.

It is generally asserted that the vacuous space between the plate P and the filament F is conductive only to oscillations in one direction, hence when the condenser C-2 discharges into the valve elements, the alternating current of radio frequency is converted into a pulsating direct current which charges the condenser C-1 and thus actuates the head telephones.

The complete circuit for this detector, as shown in Fig. 16, includes the primary and secondary winding of the receiving couplers P and S, the secondary winding being shunted by the variable condenser of low capacity C-2. The telephones are shunted by the condenser C-1 which usually represents a value of .003 microfarad.

It is not difficult to bring this detector into a state of sensitive adjustment; it is only necessary to regulate the incandescence of the filament F by means of the rheostat R, until the best response is secured from the distant station.

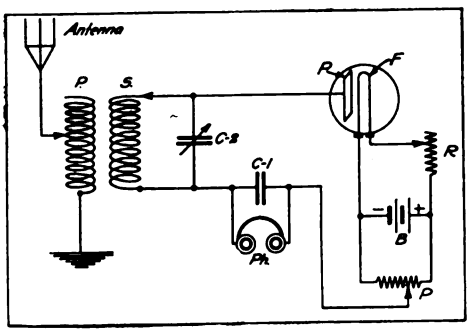


*Fig. 17*

The best results are obtained when the secondary winding S possesses a high value of inductance and the condenser C-2 a rather low value of capacity. Generally C-2 does not exceed .0002 microfarad.

The Fleming valve detector is sensitive and possesses the great advantage for commercial service of exceptional



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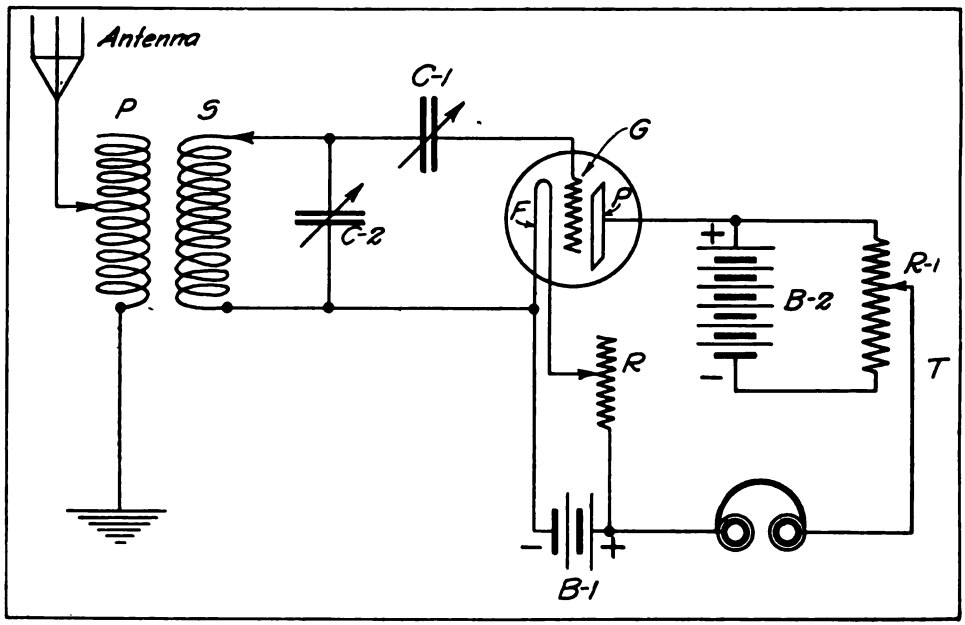


*Fig. 18*

stability and uniformity of action, being continuously operative as long as the filament burns. It is not easily influenced by the local transmitter, a highly desirable feature at a busy commercial station.

**Another Circuit for the Fleming Valve**

The circuit for this detector is sometimes altered as in the diagram, Fig. 17, wherein a potentiometer, P, is employed and a small value of potential sent through the vacuous space in the bulb between the plate and the filament. In this case the potentiometer has a value of about 400 ohms, the rheostat R about 10 ohms and the remainder of the circuit is identical with that given in the diagram Fig. 16.

To adjust the detector in this circuit, the rheostat R and the sliding contact of the potentiometer P are brought into action, corresponding adjustments being made of both until the loudest signals are obtained from the distant transmitting station. If desired a second set of batteries may be employed for the potentiometer circuit, but the same results are obtained with the connection given in the diagram Fig. 17.

**The Three Element Valve**

A modification of the Fleming valve is the three element vacuum valve, which, in addition to the elements indicated in Fig. 17, has a platinum grid G placed between the tantalum filament and the plate, as in Fig. 18. In this circuit, in addition to the lighting-battery B-1, we have the second battery B-2 connected in series with the head telephones, the circuit continuing from the plate P to the filament F through the space in the bulb. The battery B-2 is adjustable in value between 25 and 60 volts for ordinary work. Sometimes it is shunted by the potentiometer R-1 of 2,000 ohms resistance and then, by movement of the contact T, the current flow in that circuit can be very closely regulated.

**Circuit for Operation**

The usual primary and secondary windings are represented at P and S and the shunt condenser at C-2. The condenser C-1 may be of fixed or variable capacity but in any event it must not exceed .0003 microfarad for ordinary usage. The condenser C-2 also has low values of inductance at all

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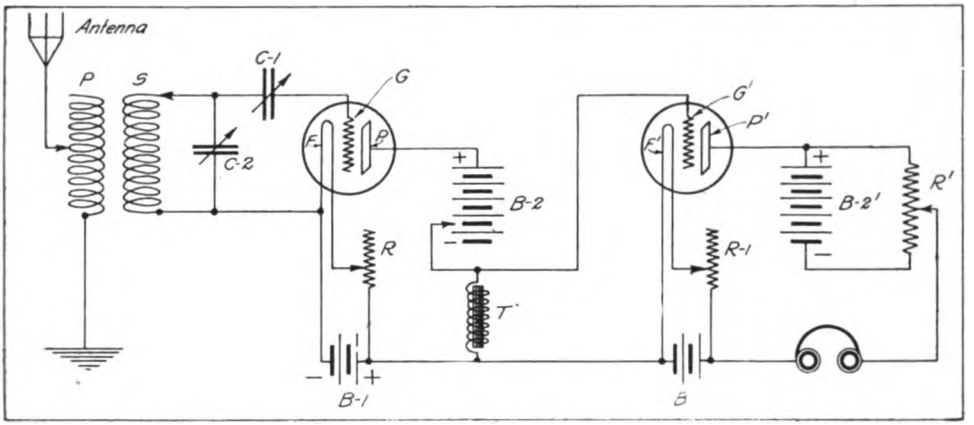


*Fig. 19-a*

wave-lengths for it is preferable in a circuit of this type to have inductance predominate.

When two bulbs are employed as an amplifier this condenser may be eliminated, but for certain classes of work the diagram, Fig. 18, is preferred.

It is important that the plus pole of the B-2 battery be connected to the plate P and that the negative terminal of B-2 be connected to the positive terminal of the lighting battery B-1.

If the vacuum valve is not highly exhausted and one in which considerable gas is present, the filament F is brought to a certain degree of incandescence by the rheostat R and adjustment made of the B-2 battery until the best response is secured. If too much voltage is applied at the Battery B-2, a characteristic blue glow appears which may or may not destroy the sensibility of the valve. Generally, however, the bulb is worked just below the blue glow adjustment and will then give the best response. When the bulb is highly exhausted the blue glow is not evident, even when very high voltages are applied to the local telephone circuit. The operator in adjusting a vacuum valve to sensibility should try various degrees of incandescence and various values of voltage at the battery B-2, until good response is secured, and to prolong the life of the filament he should hold to that adjustment which allows the lowest degree of incandescence.

### Vacuum Valve Amplifier

Two three-element vacuum valves may be used for amplification purposes, as in the diagram Fig. 19-A. Two

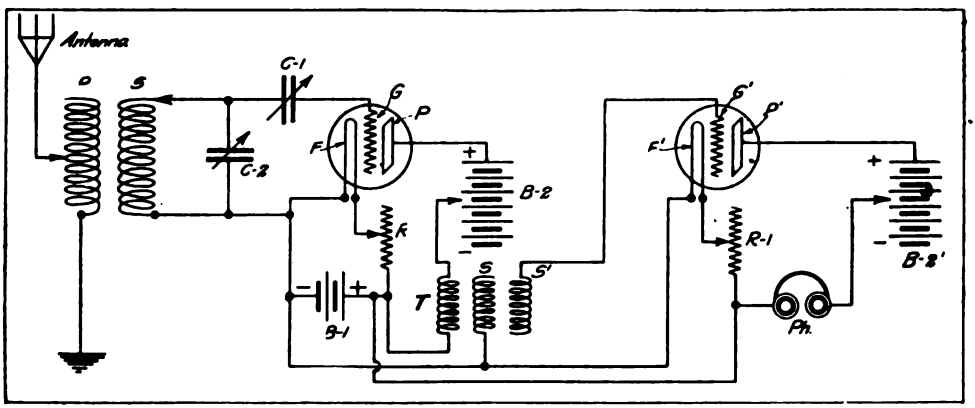


*Fig. 19-b*

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bulbs, of standard construction, are connected in cascade, through the impedance coil or auto-transformer P, having a value between 5,000 and 10,000 ohms, (iron core impedance, No. 34 and No. 36 S. C. C. wire). By means of this coil any variation of current flow in the local battery circuit B-2 is transferred to the grid and filament of the second vacuum valve, wherein the pulses of energy are again amplified.

Some experimenters report better results by the use of an inductively coupled transformer at the point P. This transformer may have a one to one ratio of

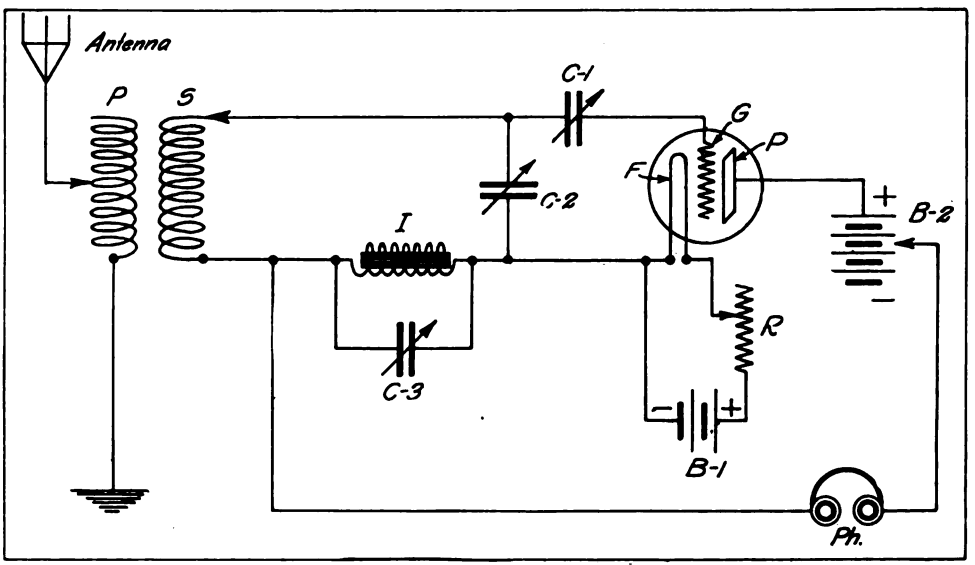


*Fig. 20*

turns, or a slight step-up ratio; generally the primary and secondary windings represent a value of approximately 5,000 and 7,000 ohms resistance respectively. The windings are of course fitted with an iron core.

In a 2-step amplifier of this type, the first vacuum valve generally burns at a low degree of incandescence, while the second vacuum valve must be adjusted to a relatively high degree of incandescence.

The circuit indicated in Fig. 19-A may be altered as in Fig. 19-B and in this case the transformer T has two secondaries, S and $S^1$, which are left open at the ends and connected exactly as shown. This transformer may or may not have an iron core, provided the inductance values are the same in either case. Usually good results can be obtained by a primary winding having a resistance of about 5,000 ohms, while the secondary windings S and $S^1$ may have 2,500 ohms respectively. By means of this connection a single storage battery unit may be used for lighting all filaments without interfering with the sensibility of the apparatus.

Experiment seems to indicate that with 2, 3 and 4-step amplifiers, the successive filaments must be burned at various degrees of incandescence. Usually valve No. 1 may be burned at a rather low degree, but Nos. 2, 3 and 4 must be burned at increased degrees of incandescence successively; the local battery of each valve at the same time is adjusted just below the blue glow point and at a safe value to present complete ionization of the vacuous space.

### Another Method of Amplification

While remarkable results can be obtained by the two cascade systems of amplification on spark signals described in Figures 19-A and 19-B, very good amplification can be obtained on a single three-element bulb by the use of diagram indicated in Fig. 20. Here the energy from the local battery B-2 makes connection with B-1 and the vacuum valve fila-

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ment through the impedance coil 1 of 3,000 to 5,000 ohms resistance. This coil is in turn shunted by the condenser C-3, of .001 to .005 microfarad capacity, in order that the oscillations of radio frequency in the secondary circuit may be permitted to pass to the vacuum valve. Any variation of current flow in the telephone circuit is sent back to the grid circuit and thus amplified.

A modification of this circuit is shown in Fig. 21, where the grid circuit of the valve and the local telephone circuit are coupled together by the condenser C-3, which is connected in shunt to the telephone and the battery B-2. By very careful adjustment of the condenser C-3, and of the telephone circuit voltage at the battery B-2, and correspondence adjustment of the incandescence of the filament a point will be found where considerable amplification is obtained from either damped or undamped stations, but the best response with this circuit is secured at wave-lengths in excess of 1,000 meters.

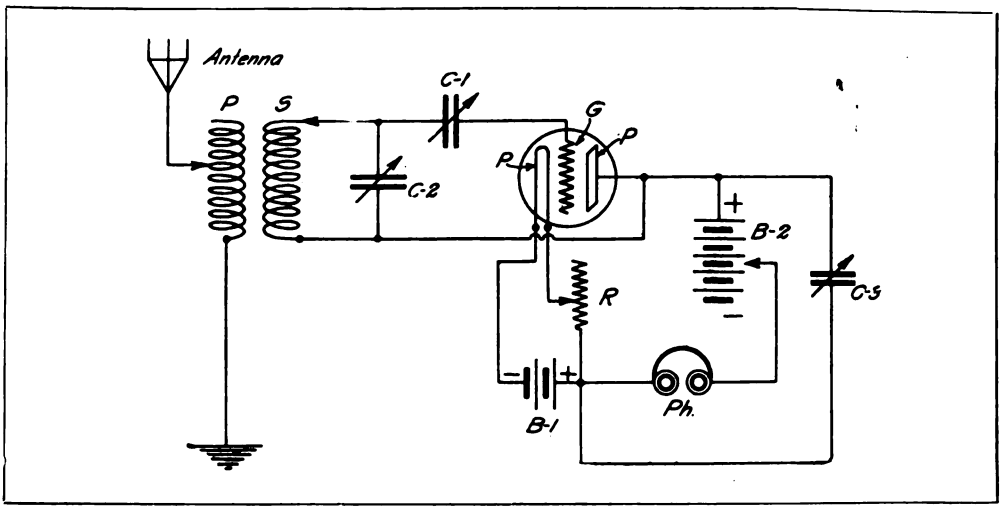


*Fig. 21*

### "Beat" Receivers

As mentioned previously, ordinary crystalline detectors cannot be used for the reception of undamped oscillations nor can the vacuum valve detector, unless the circuits of either are interrupted by a ticker or a buzzer at a certain uniform rate ranging between 500 and 1,000 times per second. We can, however, in such systems make undamped oscillations audible by what is known as the "local interference" method, sometime termed the "heterodyne effect" or the "beat" phenomenon.

It is a well-known fact that if sound notes of slightly different pitch or frequency are made to impinge upon a given receiving medium, a "beat" note of increased intensity is produced at regular recurring periods—this note generally having a frequency equal to the numerical difference between the two applied frequencies.

A similar action takes place when two alternating currents of radio frequency but of slightly different periods are allowed to flow in the aerial circuit of a given receiving system. A "beat" note having a pitch equal to the difference between the frequencies of the two applied currents, is produced.

Now in a wireless receiving system one of these frequencies may be that set up by a distant transmitting station, and the other may be supplied by energy from a local generator such as an arc generator. The requirements of this system are indicated in the diagram, Fig. 22, where the aerial of the receiving station is represented at A, with the radio frequency coils P and S' connected in series. A standard receiving detector circuit is represented by the secondary winding, S, the secondary condenser, C-2, the fixed condenser C-1, the crystalline detector D,

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and the head telephones, PH. An arc generator for the production of sustained oscillations is represented by the arc gap G, the variable condenser C', and the inductance coil P', which is in inductive relation to the coil S'. The arc gap is fed with from 110 to 500 volts D. C. through the impedance coils T and T'. When the arc gap is set in proper adjustment, the frequency of the oscillation generator may be regulated by means of the variable condenser C', and consequently any frequency with given limits supplied to the antenna system through the oscillation transformer P', S.

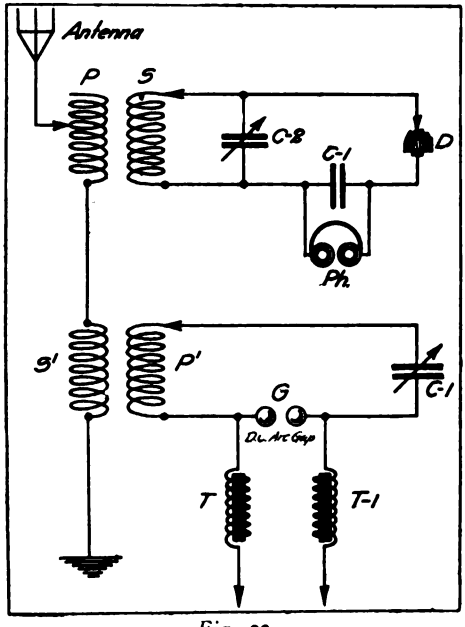

Fig. 22

Assume for example that the wavelength of the distant transmitting station using undamped oscillations is 6,000 meters corresponding to a frequency of 50,000 cycles per second. Then if the antenna system with the elements P and S is placed in resonance with the distant transmitting station, alternating currents of this frequency flow. Then if the arc generator is set at such values of inductance and capacity as to give a frequency of 49,000 cycles per second, forced oscillations will be set up in the antenna circuit through the coupling coil $P^1$ S', and the interaction of these two frequencies will produce a pitch or "beat" note of 1,000 cycles. This current of audible frequency is afterward rectified by the crystalline detector D, which in turn charges the condenser C-1, the discharge of the latter causing a single sound in the head telephones By slight variation of the frequency of the local arc generator the pitch of the note may be altered over given limits; in fact, it can be varied from the equivalent note of a 200 cycle alternator up to and beyond the limits of audibility. In this system it is important that a certain critical degree of coupling be used in the transformer $P^1$ S', and that the crystalline detector D be one of rugged adjustment and not easily influenced by the oscillations from the local generator. If the generator G, $C^1$, $P^1$ can supply 4 or 5 watts of energy, it will be sufficient for the functioning of this system.

A small high frequency alternator may be employed in place of the local arc generator, as indicated in the diagram

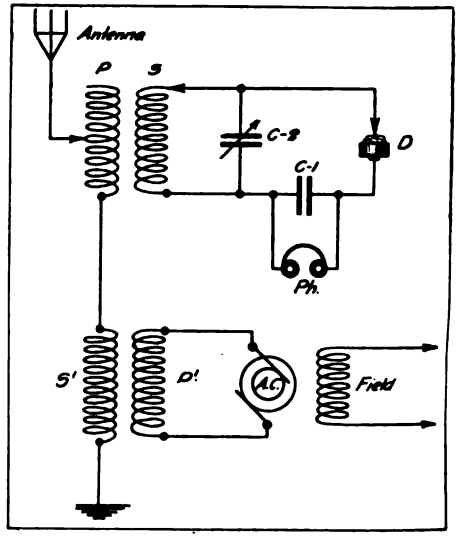

Fig. 23

Fig. 23, where an alternator of radio frequency (20,000 to 100,000 cycles per second) is connected to the radio frequency coil $P^1$ which is placed in inductive relation to S'. Then by variation of the speed of the alternator variation of the applied frequency is secured, which may be used to interact with the frequency of the distant transmitting station precisely as in the previous case. A generator having an output of 2 to 10

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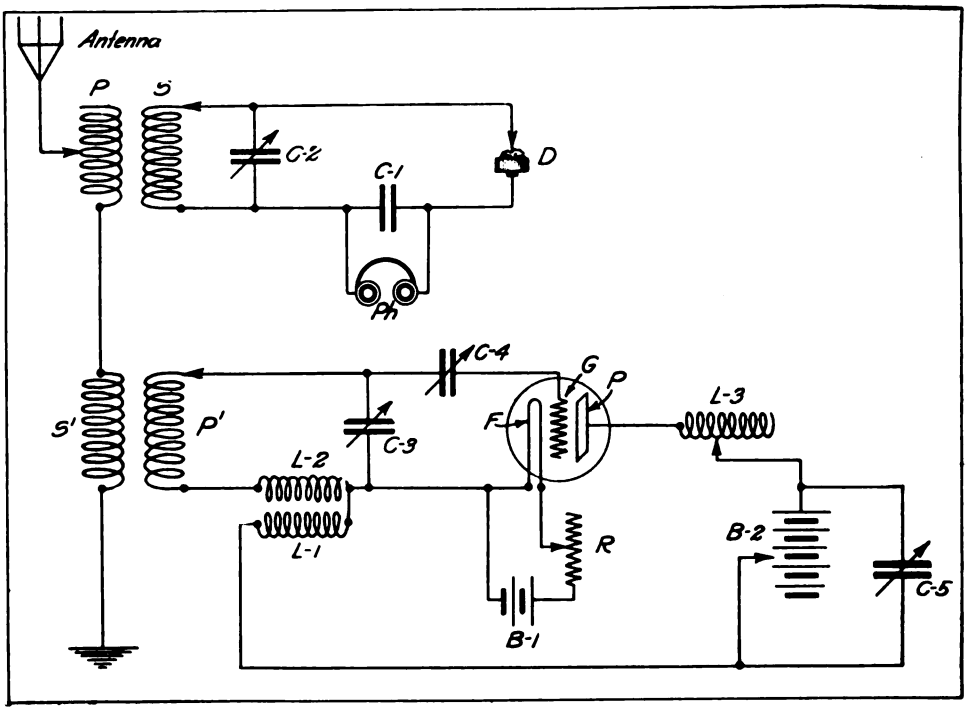


*Fig. 24*

watts is all that is required for this system.

**Vacuum Valve Generator**

Instead of the arc generator or radio frequency alternator just described, we may use the vacuum valve to generate undamped oscillations of any frequency desired. The circuits for this system (Fig. 24), are more complicated than in the foregoing methods, but good results have been obtained by various experimenters, signals having been received in the United States from stations located in foreign countries with marked intensity. Referring to Fig. 24: The standard crystal detector circuit is identical with that of Fig. 23, and contains the necessary elements for obtaining conditions of resonance, but the vacuum valve circuits are arranged so that the bulb becomes a fairly steady generator of sustained oscillations, the frequency of which may be varied in accordance with the requirements. It will be noted from the diagram that the B-2 battery, of the vacuum valve is shunted by the variable condenser C-3 in series with which is placed the induction L-3. When the correct degree of incandescence is obtained at the filament and proper variation of the voltage of the B-2 battery made, sustained oscillations flow from the condenser through the inductance L-3, across the vacuous space in the bulb at a frequency which may be altered by either the condenser C-3, or the inductance L-3. The amplitude of the oscillations generated in this manner may, however, be reinforced and the device perhaps made a more steady generator by coupling the local telephone circuit to the grid circuit of the vacuum valve through the radio frequency transformer L-1 and L-2. Then by placing these two circuits in resonance or near resonance, steady oscillations are produced which in turn can be sent into the antenna circuit through the radio frequency transformer $P^1$, $S^1$, that is to say, the best results are obtained when P', L-2, C-3 is in resonance or near to resonance with L-1, L-3, C-3.

It may be difficult for the beginner to obtain the correct adjustment for securing a steady state of oscillation in the vacuum valve bulb, but one accustomed to work of this type will have no diffi-

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culty in determining the condition. Usually the state of oscillation may be more quickly determined by connecting a head telephone in series with the battery B-2 and then when the circuits are in state of oscillation there will be found near to that point a peculiar thumping sound when the frequency of either the grid circuit or the local battery circuit is altered.

The vacuum valve bulb having thus been set into a state of oscillation, the current of radio frequency may be forced in the antenna through the secondary winding of the coupling transformer S-1 and this frequency may be made to differ by a certain amount from the incoming frequency, and the result will be a "beat" note of any desired pitch, from a low grumbling note to an extremely high tone. To obtain the best signals the coupling between P-1 and S-1 is critical and careful adjustment must be made.

For a more sensitive combination the crystalline detector D may be eliminated from the circuit and a second vacuum valve detector of a considerable degree of sensibility substituted. In fact the signals from this valve could be amplified by 2 or 3 additional valves thus obtaining an extremely sensitive receiving set which would permit the reception of signals over very long distances.

In previous issues of this series, also in the successive issues of the National Amateur Wireless Association bulletins, the dimensions for coils suitable to the vacuum valve generating circuit are published.

*(To be continued)*

### Successful Commerical Tests With Japan

The third and final series of tests for trans-oceanic service between Honolulu and Japan by means of the Marconi station in Hawaii and the stations of the Imperial Japanese government at Funabashi, has just been completed. Telegraphic reports indicate that these tests were by far the most successful of any so far made, communication having been maintained night and day in both directions.

The Director-General of Posts and Telegraphs and his suite visited Funabashi recently and sent the following messages to E. J. Nally, Vice-President and General Manager of the Marconi Wireless Telegraph Company of America:

"We are hurrying to conclude arrangements and came here to see final test and find same satisfactory. We send you our best compliments on this occasion.

"Best operators in these tests will be appointed within a few weeks and inauguration of commercial service will be announced as soon as possible."

### Operator Balks Mexicans

That Mexican bandits failed to add another American life to the long list of their victims is due to the coolness of Marconi Operator Outtner of the C. A. Canfield. On June 25th, while the steamer was lying at Tampico, William Green, manager of the Hausteca Petroleum Company, begged to be hidden from men who were seeking to kill him. A few minutes later a Mexican officer boarded the ship with a squad of soldiers and informed the captain of the Canfield that Carranza officials had given him orders to shoot Green on sight. But here the wireless entered into the situation.

In the radio cabin Outtner was calling the U. S. S. Machias, lying nearby, and a surprise was arranged for the Mexicans in the shape of a lieutenant from the Machias, backed up by bluejackets armed with rifles, who quickly drove the Mexicans from the Canfield.

### Cuban Telegraph Experts Here

The Cuban government has sent a commission consisting of Messrs. Frenando Aenlle, Manuel Mallo and Arturo Novo, to study the telegraph, telephone, and wireless systems of the United States. The Marconi Company has extended to the Cuban representatives the privilege of inspecting its ship and shore stations, as well as the high-power stations at Belmar and New Brunswick, N. J., and the school of construction and general methods of conducting radio-traffic.

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# Long Distance Transmission on Low Power and Short Wave-lengths

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**By A. S. Blattermam, B.S.**

**PART I**

THE attention of wireless telegraphists must have been attracted to the numerous recent reports of long distance transmission by amateur transmitters using low power and very short waves, and there is no doubt that there are many well authenticated cases where transmission over very considerable distances is being regularly conducted on the 200 meter wavelength and 1 kw. of power allowed by the federal statutes. The writer's personal observations support the general trend of the claims put forth by certain successful operators, and though a great many of the reported records have probably occurred in the nature of freaks and probably a considerable number on wave-lengths greater than 200 meters, yet it is likely that in many cases there existed a happy combination of circumstances which has resulted in successful communication on a fairly regular schedule over distances quite above the average figure usually given for the range of amateur sets. It is the purpose of this article to present the probable reasons for the highly satisfactory results obtained at some stations and to reduce them through proper analysis to data and formulas which will enable experimenters to reproduce the several enviable results already reported; in short, it is proposed to give directions for obtaining the maximum range of an amateur set operating on the very restricted wave-lengths imposed by legislation.

There are a number of features embodied herein which are not thought to be generaly appreciated, and they will constitute an addition to the technical data at the average amateur's command. It is thought that the material following will be especially useful at this time in view of the increasing recognition given to the amateur, particularly by the government, and the desirability, therefore, as a potential government institution, of supplying the amateur field with information permitting the utilization of his restricted power and short wave to the fullest advantage.

### Effect of Wave-Length on Range

In the August 15, 1914, issue of the Electrical World the writer showed by means of a graphical analysis of the Austin-Cohen transmission formula, that for a particular given distance between two stations there existed a certain critical wave-length which gave the strongest signals, and for a given transmitting aerial and given antenna current there was one definite wave-length which would give the maximum range. A method was also worked out whereby this particular wave-length could be accurately determined.

If the methods of the original paper be applied to the particular case of the short wave, small antenna, low-power amateur set, some interesting and very important results are obtained.

The Austin-Cohen transmission formula which was developed after an extended series of tests on the Atlantic Ocean, carried on under the auspices of the United States government, has been found to be very accurate in predetermining the range of wireless stations of



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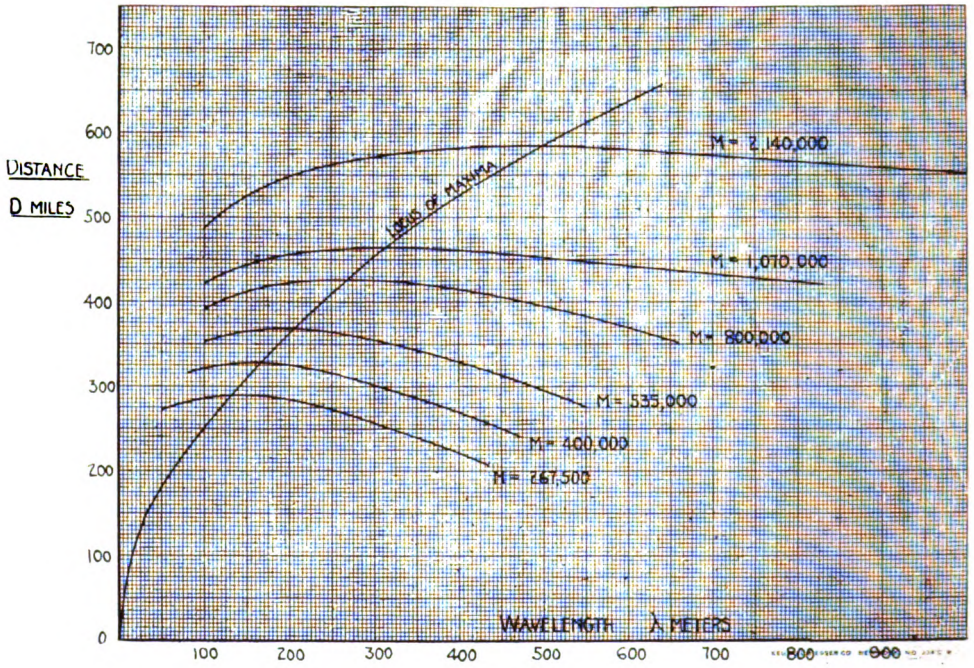


*Fig. 1*

the spark type and is accepted by engineers as the most reliable formula for this purpose now available. This formula is:

$$I_1 = \frac{635\ I_s\ h_1\ h_2}{\lambda\ d}\epsilon^{\frac{-0.0762\ d}{\sqrt{\lambda}}} \quad \ldots\ (1)$$

where:

$I_1$ = current in the receiving aerial in microamperes.
$I_s$ = current in the sending aerial in amps.
$h_1$ = height of sending aerial in ft.
$h_2$ = height of receiving aerial in ft.
$\lambda$ = wave-length in meters.
d = distance in miles.

The factor 635 in the above equation is only correct for a receiving antenna of approximately 25 ohms equivalent resistance, which is probably a little lower than obtains in most amateur stations on land. The factor 0.0762 is the absorption coefficient; that is, it is the measure of the rapidity with which the waves are absorbed in their travel. The above value applies to transmission over sea water. It is almost certain that when the transmission is over land, especially in daylight, the absorption is much higher than that indicated by the figure referred to. However, from tests* carried out recently between Washington University and the University of North Dakota, it appears that the oversea-water absorption coefficient is nearly correct for overland transmission in the twilight hours near sunset and sunrise if it be assumed that the transmission is unabsorbed near midnight. It is therefore very likely that the formula given applies closely as it stands to late afternoon and early evening transmission over land.

If we denote by M the quantity

$$M = \frac{635\ I_s\ h_1\ h_2}{I_r}$$

the equation can be reversed and written:

$$d - \frac{M}{\lambda\,\epsilon^{\frac{0.0762d}{\sqrt{\lambda}}}} = 0 \quad \ldots\ (2)$$

This is the form of the equation we shall examine.

* A. H. Taylor and A. S. Blatterman, "Variations in Nocturnal Transmission," Proc. I. R. E., April, 1916.

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In calculating M it is necessary to know the value of the receiving antenna current $I_r$. Austin has determined that this is about 10 microamperes for signals of just readable strength on the apparatus used by him in the 1912 tests, and 40 microamperes for fairly strong signals which can be read through moderate interference. It is likely that these values are about right for the amateur set to-day where the three-element vacuum valve is used.

Obviously, the value of M is a measure of the radiative power of the transmitting station and the strength of the signal at the receiver. If M be given different arbitrary values corresponding to different antenna heights and currents and the equation 2 solved* for distance in terms of wave-length and the results plotted, a set of curves are obtained as shown in Fig. 1.

The first important thing shown by these curves is that for any given value of M there is a maximum of distance corresponding to a particular wave-length. For instance, if the value of M for a given station is 535,000, which is true if $h_1 = h_2 = 60$ ft., and $I_s = 2.45$ amperes for each 10 microamperes required in the receiving antenna, then Fig. 1 shows that the best wave-length to use is 200 meters; and for the assigned signal strength at the receiving station corresponding to 10, 20, or 40 microamperes in the receiving aerial which was used in calculating M, the maximum range is 370 miles.

The wave-lengths for which d is maximum at the different values of M in Fig. 1 can now be plotted against the corresponding values of M and the curve marked "wave-length" in Fig. 2 obtained. This curve shows the best value of wave-length to use for different values of M. Similarly, the maximum distances of Fig. 1, at different values of M, which can be obtained by the proper selection of wave-length, can be plotted to M and the curve marked "distance" obtained, as in Fig. 2.

These curves of Fig. 2 can now be used to determine the proper wave-length for transmission over any distance up to 600 miles, which covers all

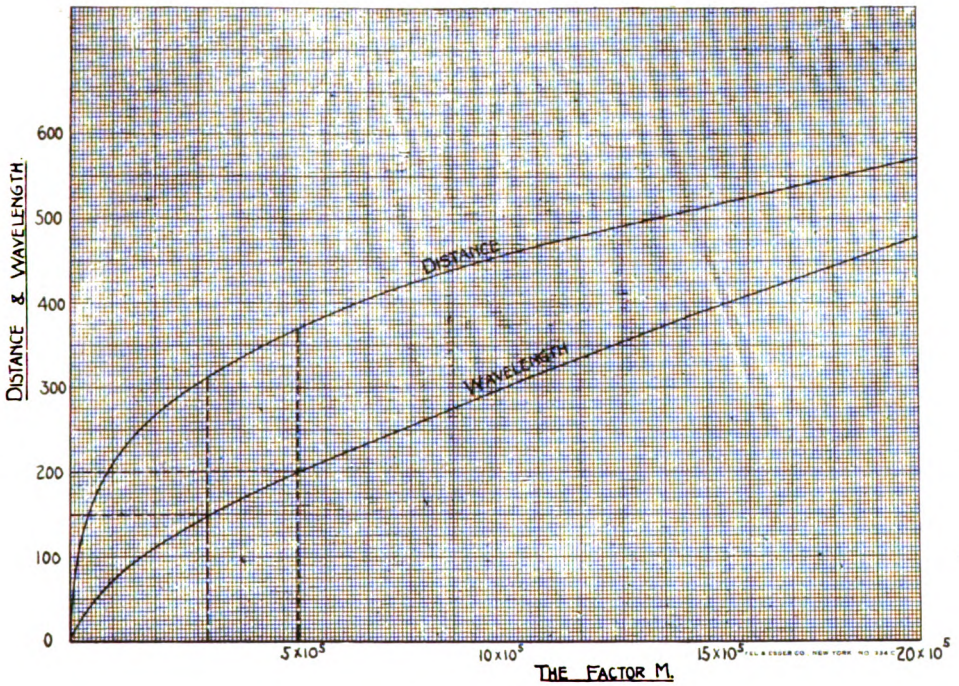


*Fig. 2*

* A. S. Blatterman, "Determination of Wave-length," Electrical World, August 15, 1914.

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that the amateur usually needs, and corresponding to this wave-length and distance the value of M required; or if M can be calculated from the dimensions of the sending and receiving aerials and the currents therein, the curves can be used to determine the greatest distance which can be covered with the assigned value of $I_r$, and simultaneously the wave-length which is proper to this distance and the power at hand.

As an example, suppose it is desired to transmit 325 miles. The "distance" curve of Fig. 2 shows that M must be $3.25 \times 10^5$. But the desired distance, 325 miles, can only be covered with this value of M when the wave-length is that read from the "wave-length" curve (Fig. 2) corresponding to this M, namely, 150 meters. A wave very much longer or very much shorter than this will reduce the range. These curves, therefore, are of great practical significance.

For any value of M a choice of antenna height and received signal strength immediately fixes the magnitude of the sending aerial current $I_s$, and this is a direct index of the power to be used at the sending station. There is, however, a certain limitation usually imposed on the amateur. That is, his range of wave-lengths is very restricted. He must, usually, not exceed 200 meters, and since this involves questions of antenna height, sending aerial current producible, antenna voltage and effective overall resistance of the antenna, the problem presented is not quite so simple as it is with the commercial and government station with less restricted wave-lengths and powers. In the amateur station the adjustment of antenna dimensions to wave-length and current, and the selection of wave-length for maximum distance is very critical. If the proper combination of these quantities is obtained the results are surprisingly good, while even small deviations from the correct adjustments lead to very indifferent results. We shall return shortly to a more critical examination of these details.

An important fact is shown by the curves of Fig. 1. This is that the wave-length giving extreme range does not necessarily produce the strongest signals at shorter distances. For instance, suppose $h_1 = h_2 = 75$ ft., $I_s = 3$, and $I_r = 10$, that is, signals are just audible and we are working at the extreme range.

$M = 63.5 \times 75 \times 75 \times 3 = 1{,}070{,}000$.

Referring. to the proper curve of Fig. 1 for this value of M, it is seen that the best possible wave-length to use is 320 meters and the distance obtainable if this is used is 465 miles. At a station closer in to the transmitter, say at 370 miles, however, this wave-length will not produce the strongest possible signals; but we find, by referring to Fig. 1, that the strongest signals are produced at 370 miles, for the given values of $h_1$, $h_2$ and $I_r$ by using the wave-length 200 meters.

We thus reach the conclusion that for the strongest signals at distances below the maximum range of the station short waves should be used.

And in general it appears that for a given aerial and power there is a certain optimum wave-length which gives maximum transmission, and it is therefore of great importance, especially where only a small power is initially available, properly to correlate the wave-length with the size of the antenna and the current produced therein.

To determine the best wave-length for any distance the following formula may also be used, which is the equation of the curve in Fig. 1 marked "locus of maxima."

$$\lambda = 0.00145\ d^2.$$

This, however, says nothing about the size of the aerial nor the antenna current. The curves above are therefore recommended for use when the latter quantities are wanted.

**Form Factor and Radiation Resistance**

It is well known that in an antenna oscillating in its natural period the distribution of potential and current along it are such as to produce a maximum of current with zero potential at the earth connection and zero current with maximum potential at the free end, and that the current and potential vary along the aerial from zero to maximum approximately according to a sine law.

Now picture a vertical aerial in which the current is the same at all points, a merely hypothetical case, in which an

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ammeter, if it were placed in the aerial at different points, would always read the same. If the height of this aerial be h meters, the wave-length λ meters and the current I amperes, then it can be shown that the power radiated in the

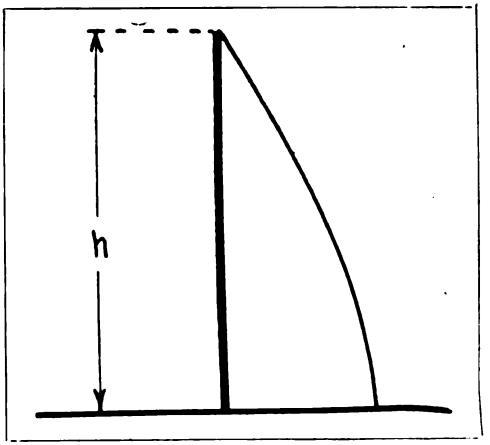


*Fig 3*

form of electromagnetic waves is:

$$P = 1600 \frac{h^2}{\lambda} I^2 \text{ watts} \quad \ldots\ldots\ldots\ldots \quad (3)$$

Actually, now, the current distributes itself along the aerial, as stated above, so as to have different values at different points, with a maximum at the earth and zero at the extreme free end. Its value at the earth is measured by a hot-wire ammeter. If we wish to calculate the power radiated, however, we must use, not the value at the base, but the average value along the whole aerial. This average value is, of course, less than the maximum value at the base. It is

where

$$I \text{ aver.} = \infty I$$

I = current at base of aerial.

∝ = a quantity less than 1 depending on the manner in which the current is distributed.

If the distribution is sinusoidal, as in Fig. 3, the average current is $2/\pi$ times the maximum at the earthed end of the aerial; i. e., $\infty = 2/\pi$. If the distribution is linear, as in Fig. 4, the average value is ½ the maximum, ∝ = ½.

Thus, the power radiated is:

$$P = 1600 \frac{h^2}{\lambda^2} \propto^2 I^2 \quad \ldots\ldots\ldots\ldots \quad (4)$$

This can be written:

$$P = 1600 \left(\frac{\propto h}{\lambda}\right)^2 I^2 \quad \ldots\ldots\ldots \quad (4a)$$

∝ is termed the "form factor," and "∞ h" the effective height of the aerial.

If the aerial is bent over at the top so as to form a flat-top then it is only the vertical portion, of height h, that is effective in radiating energy, and hence it is only the average value of the current in this portion which is used. In other words, the form factor ∞ only denotes the average value of the current in the vertical part of an aerial so constructed.

The following formula may be used to calculate the form factor for any flat-top aerial oscillating near its fundamental period.

$$\propto = 0.637 (1 + L/) \text{ Sin } \left(\frac{h}{h + L}\right) 90°$$

where

L = length of horizontal part for inverted L aerials.

= half total flat-top length for T aerials.

h = Height of vertical part.

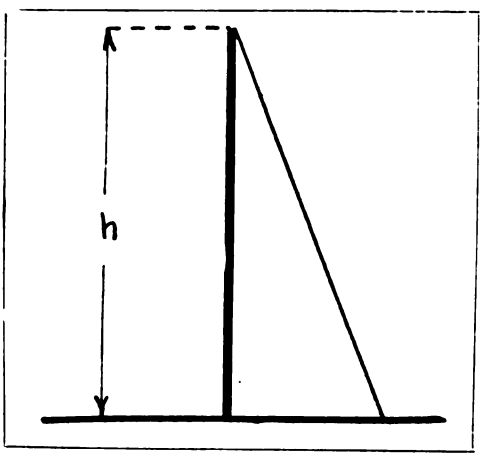


*Fig. 4*

When part of the aerial is inclined, as in Figs. 5 and 6, then the current distribution for the total height can be worked out as follows. Draw the light line curves a and b showing the current distribution in each part of the aerial. Then at each point in the height h, as at P, draw a line parallel to earth whose length equals the sum of all the currents

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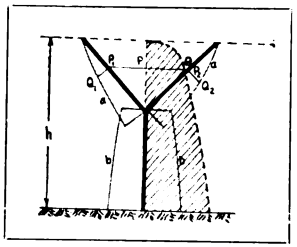


Fig. 5

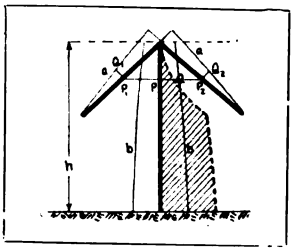


Fig. 6

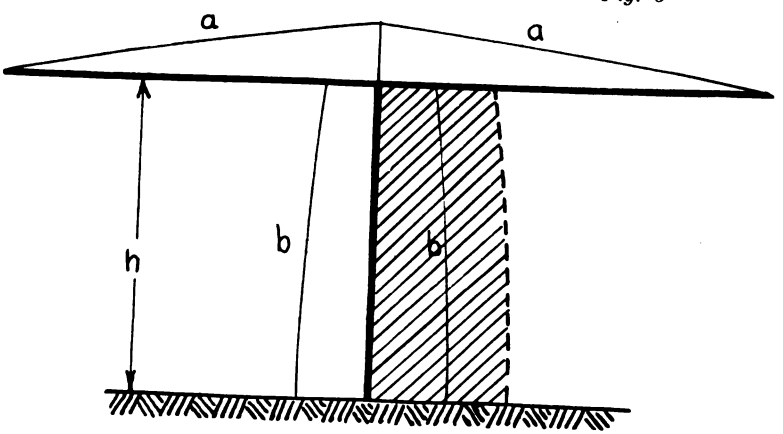


Fig. 7

in the different parts of the aerial at points of the same height as P. Thus, at P we get the length $PQ = P_1Q_1 + P_2Q_2$. If a line is drawn through the extremities of all the horizontal lines obtained in this way for every point in the height h, we get a curve which shows the equivalent current distribution throughout the height h.

The shaded curves of Figs. 5 and 6 were obtained in this way. It will be noticed that the average current, that is, the form factor, is much better for the aerial of Fig. 5 than it is for the umbrella type aerial of Fig. 6. It is still better for a large flat-top aerial, as will be seen by referring to Fig. 7; it is practically unity when the flat top is very large, because in that case the current is practically the same at all points of the vertical portion.

Thus, where the total overall height is the same, a flat-top aerial or one like Fig. 5 produces a higher average current distribution and is, therefore, a more powerful radiator than the umbrella type. This is because the current flowing down in the inclined portions of the umbrella partly neutralizes the current flowing up in the vertical part.

*(To be continued)*

## AN UNUSUAL SHIP RECEIVING RECORD

The Oceanic Company's steamer Sonoma, which recently arrived at Sydney from San Francisco, was not out of touch with land from the time she cleared the Golden Gate till she entered Sydney Heads. Throughout the voyage the vessel was able to obtain news of the war and other important world events from the American side, no news being available from any of the stations in Australia or Fiji. At a distance of 4,700 miles she was able to keep informed, while the receipt of news at a distance of 2,300 miles was quite an ordinary performance. This is very creditable as the distance between the two ports is about 7,000 miles.

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# From and For those who help themselves

Experimenters' Experiences.

*The editor of this department will give preferential attention to contributions containing full constructional details, in addition to drawings.*

## FIRST PRIZE, TEN DOLLARS

### A Transmitting Station of Moderate Cost

The apparatus and aerial system which I am about to describe can be constructed at moderate cost and with the materials available in the usual amateur's workshop. The panel type of transmitting apparatus has proven very popular to readers and I am sending, accompanying this article, a complete set of drawings for one which I have actually constructed, and which may prove of interest to the experimenter. An assembled view of the equipment appears in Fig. 2, and the dimensions for the panel and the supporting angle arms in Fig. 1. At the bottom of the panel indicated in Fig. 2 is a three-point switch for regulating the number of turns in use in the primary winding of the high potential transformer. In the lower right hand corner is a small double-pole switch for starting and stopping the rotary gap motor. To the left is a double-pole, double-throw switch for disconnecting the alternating current power mains from the primary winding of the transformer.

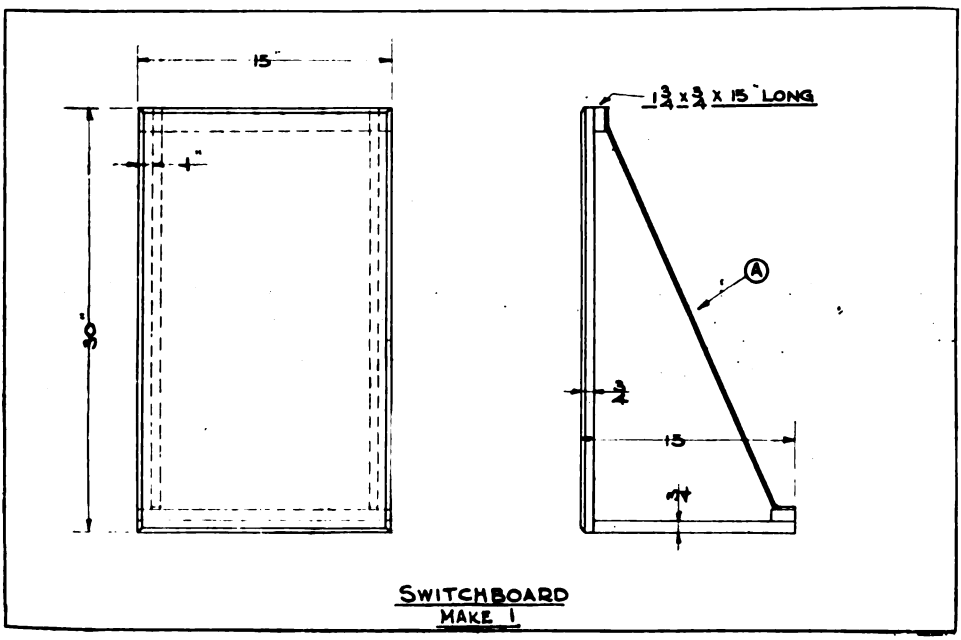


*Fig. 1, First Prize Article*



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The set is fitted with two spark gaps, one being of the rotary type which is mounted in a soundproof case immediately behind the board with a peep hole as indicated at C. A straight gap is also mounted to the right of the board which may be used in case of accident to the rotary discharger. The switch, D, permits either the straight gap or the rotary gap to be connected in the primary oscillating circuits.

A suitable motor-controlling rheostat is indicated at B and is shown in detail in Fig. 4. The tube of this controller is 1 inch in diameter and is wound with a single layer of No. 28 resistance wire.

The construction of the case for holding the rotary spark gap is shown in Fig. 5, for which detailed dimensions have not been given as every amateur has a different size of motor and will therefore have to change the dimensions to suit whatever apparatus he may have at hand. This spark gap containing case should be fitted with a cover that could be easily removed in order that the motor may be oiled as required. The switch shown at E serves the purpose of short-circuiting the aerial hot wire ammeter when it is not in use, for on account of the opening and closing of the primary circuit by the transmitting key the pointer is set into violent oscillation and will soon destroy the jewelled bearing. The small switch, F, is for connecting into the circuit the pilot lamp which is mounted directly over the hot wire ammeter.

The switchboard panel proper is made of white wood which has a good appearance and does not have to be filled before staining. In the construction of this board the use of black shellac should be avoided as I have found that it contains a very large quantity of lampblack which is a conductor to high frequency current and it may result in a considerable loss of energy; in fact it may burn out parts of the low frequency apparatus. There are other grades of black paint also which contain ore or less lampblack and they may prove rather expensive in case of accident to the apparatus.

I finished my panel board in the following manner: Having sandpapered the surface with a very fine grade of sandpaper (I was careful to rub it with the grain so as to avoid scratches), I gave it a coating of oak filler stain and left it to dry for about fifteen minutes after which it was rubbed off with a cloth. If

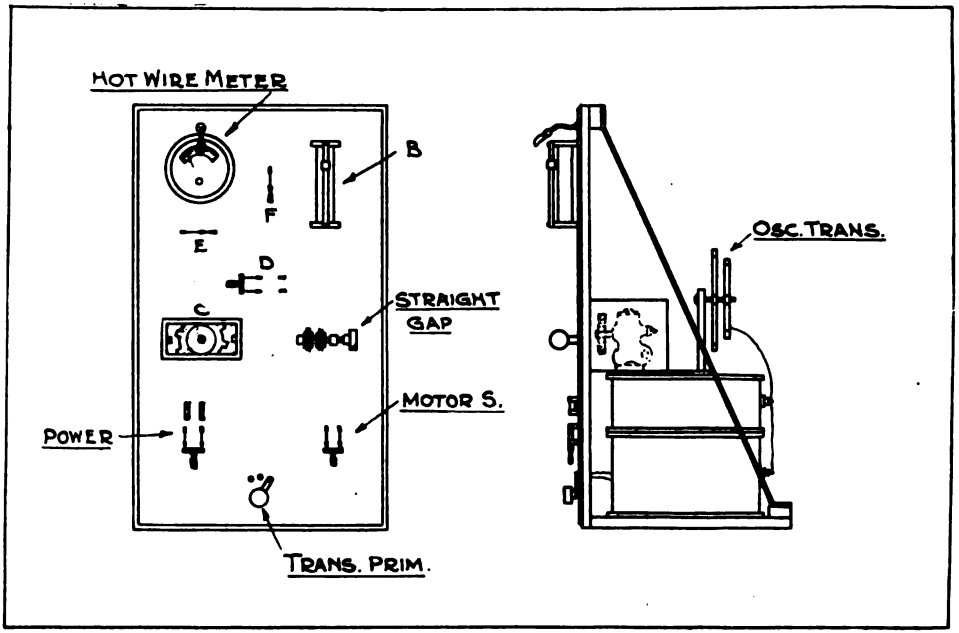


*Fig. 2, First Prize Article*

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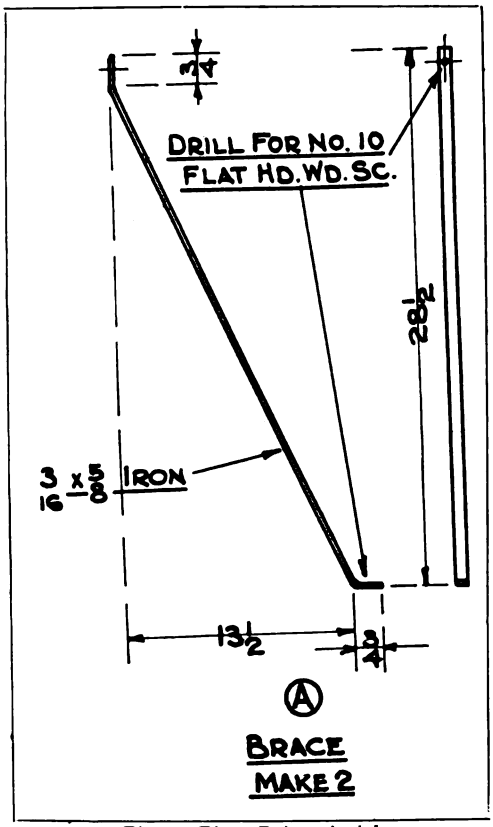
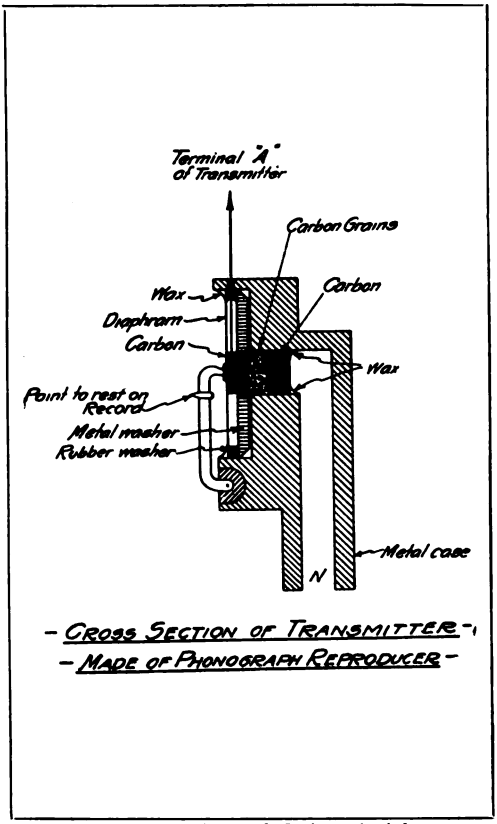



Fig. 3, First Prize Article




Drawing, Second Prize Article

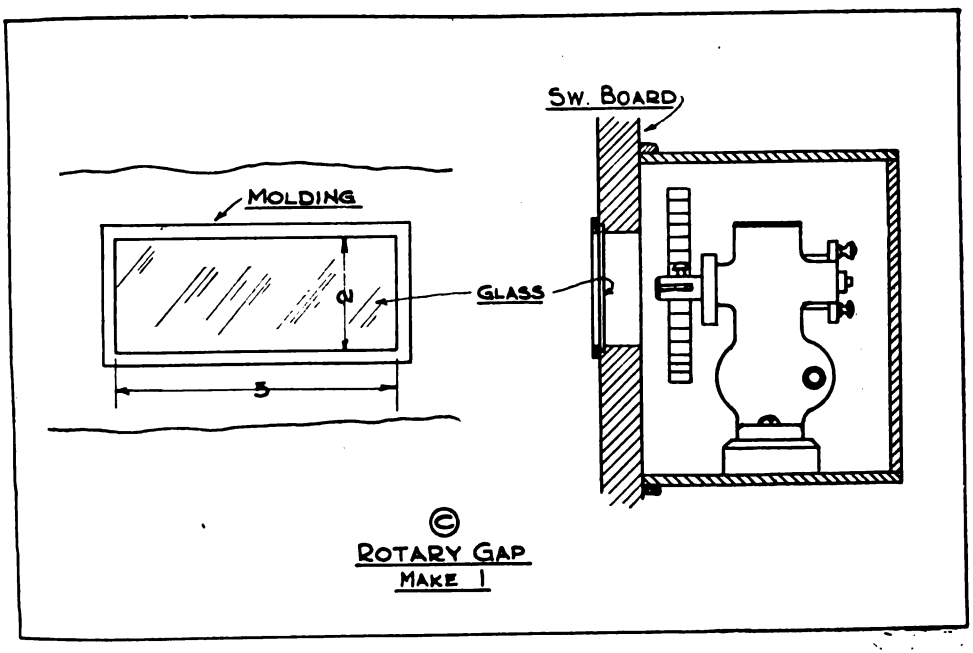



Fig. 5, First Prize Article

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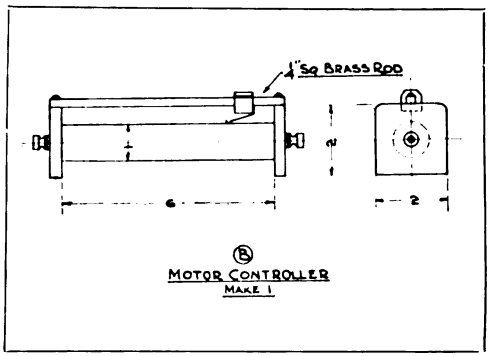


*Fig. 4, First Prize Article*

that work is done carefully it will remove the stain from the top of the grain which will make for an improvement in appearance. The panel board is now allowed to stand for a day or two, after which it is to be rubbed with a rag until a bright surface appears. This method is far superior to the use of shellac for as is well known, shellac has the properties of absorbing moisture and therefore is not desirable for high potentials.

Should the amateur wish to mount this transmitting board flush with the wall he may eliminate the braces, A, but otherwise the braces must be employed, as the panel would soon loosen up from the pulling and pushing in of the switches. For the switches I used the small Trumbull 15-ampere type, which are inexpensive. The porcelain base was removed and the clips placed flush with the panel for the sake of appearance.

I found by experiment that the range of an amateur station can be increased by the use of a balancing capacity instead of a ground connection. It is simply a two-wire aerial stretched underneath the aerial proper, care being taken to place it near to the ground. I have also found another type of simple counterpoise to be very efficient. It consists of a piece of common wire chicken-fence, pegged out flat on the ground, directly underneath the aerial and experiment would seem to indicate that it gives better results than the counterpoise which is stretched at a distance of a few feet from the earth. However, in the usual amateur station the fence wire would be in the way and consequently the counterpoise first described is the one to use.

O. COTE, *Rhode Island.*

## SECOND PRIZE, FIVE DOLLARS
### Details of a Novel Wireless Telephone Transmitter

The readers of this magazine may be interested in the details of a wireless telephone transmitter which may be attached directly to the reproducing carriage of an ordinary phonograph and thus used for transmitting the voice of a singing and talking record to a considerable distance by means of wireless waves. It is believed that the suggestion outlined herein may lead to further development, as the device has proved by experiment to be particularly effective in creating very loud signals over a wire telephone line.

The fundamental principle upon which my transmitter is based will be observed from the accompanying drawing in which a sensitive telephone transmitter has its diaphragm attached to a sharp phonographic reproducing needle which, in turn, rests directly on a record. The drawing is, in fact, a cross-sectional view of the transmitter. The wax which usually holds the diaphragm in place is removed and a carbon button with the back surface smoothed and the face filed rough, (ground to fit the hole back of the diaphragm), is attached to the diaphragm by means of small bits of melted wax. Electrical connection is made to the carbon by means of an insulated wire of the required degree of conductivity. This wire passes out through a hole in the rubber washer shown in the drawing.

Next, a carbon button is constructed like the first one and fitted to the bottom of the hole in the rear of the diaphragm. The surface of this hole may be roughed with a pointed instrument and the carbon wedged in. If this does not prove sufficient to hold it, it may be further supported by wax, at the rear through the opening, N.

The sides of the hole in which the carbon is placed should be carefully insulated with mica or wax and filled with carbon grains (made by pounding a good grade of carbon to the desired fineness). The other terminal of the transmitter case which, of course, is constructed of metal, completes the circuit.

The diaphragm proper is then put into place and waxed, after which the trans-

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mitter is ready for use. The full value of my design is best realized by experiment. I have constructed a transmitter exactly as reproduced in the figures and find that with a 2,000-ohm receiving set connected in series with an old dry cell, music can be transmitted over two wires for a long distance. The distinctness with which it can be heard is governed by the strength of the battery. I consider this a fair test of the device and I believe that it could be successfully used in wireless telephone work.

L. G. BARRETT, *New Hampshire.*

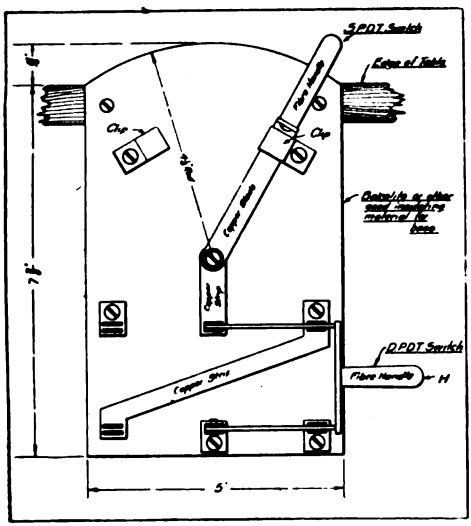


*Fig. 1, Third Prize Article*

## THIRD PRIZE, THREE DOLLARS
### A Handy Combination Aerial Change-over Switch

The low wave-length to which amateurs are restricted makes it necessary for them to employ an aerial of limited dimensions for transmitting purposes. It is the usual custom to make use of a large aerial for purposes of receiving, but in amateur stations the best results are obtained by the use of the smaller aerial for both transmitting and receiving.

I therefore found it very desirable at my station to erect two aerials, one of which was used for transmitting and receiving on amateur wave-lengths and the other for receiving signals from the higher powered stations.

The aerial change-power switch shown in the accompanying drawings was designed to give a quick change to either aerial system, and to effect this it is only necessary to move the small aerial switch to shift the connections from sending to receiving or vice-versa. The diagram of connections for this system is also very simple—a desirable feature.

The base shown in Fig. 1 should be made of some good insulating material, such as hard rubber, bakelite, etc. A 2-point, knife switch is mounted at the bottom which is fitted with a special fibre handle, H. Auxiliary contacts may be added to this switch for starting and stopping a rotary spark gap or operating any other necessary device in connection with the complete apparatus. My drawing shows the parts of the double-pole double-throw switch mounted directly on the main base, but if desired an ordinary porcelain switch may be mounted as a unit.

In the diagram of connections (Fig. 2), the black dots represent the points of the two switches and are arranged in exactly the same order and position as the points in Fig. 1.

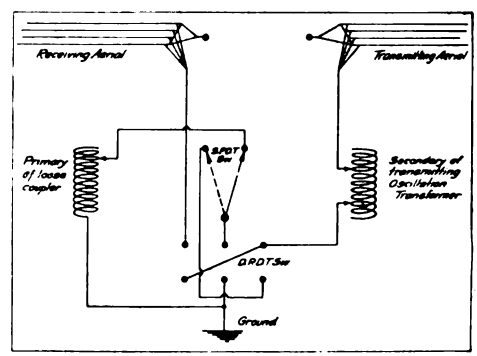


*Fig. 2, Third Prize Article*

The operation of the complete switch is as follows:

When the double-pole double-throw switch is thrown to the left, the large aerial is cut in for receiving and the transmitter connected to its aerial and the ground. Then, with the single-pole switch thrown to the right, the receiving circuit is completed through the larger aerial. When thrown to the left, the large aerial is completely disconnected from the instrument and is thus ungrounded. Upon placing the double-pole double-throw switch to the right, the larger aerial is entirely disconnected

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from all instruments. A complete receiving circuit is made through the transmitting oscillation transformer secondary and the primary of the inductively-coupled receiving tuner when the single-pole switch is thrown to the right. When the single-pole switch is thrown to the left, the transmitter is directly grounded and the receiving circuit opened up. Thus it will be seen that no matter in what position the double-pole double-throw switch may be, the transmitting circuit is complete when the single-pole switch is thrown to the left and then the receiving circuit is always complete in the opposite direction.

The handiness and usefulness of this switch will be apparent to your readers and will amply repay all trouble and expense of construction connected with it. A switch constructed after this design is in daily use at my station and gives complete and perfect satisfaction.

RALPH CHASE, *California.*

## FOURTH PRIZE, SUBSCRIPTION TO THE WIRELESS AGE

### The Construction of a Non-Synchronous Rotary Spark Gap

Readers of THE WIRELESS AGE may be interested in the details of construction for a non-synchronous rotary spark gap which I have found to be extremely efficient. Amateur experimenters are accustomed to construct a rotary gap with a revolving disc, but I prefer the type where the disc is stationary and a small arm is attached to the shaft of a motor for making electrical contact with the various portions of the disc. In addition I find that a gap of this type is much easier to construct and a smaller motor can be more readily used than with the usual type of gap.

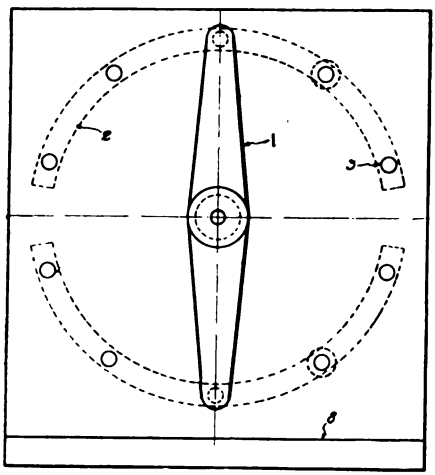


*Fig. 1, Fourth Prize Article*

Referring to Fig. 1, which is a front view of the gap with the motor removed: Detail No. 1 is a rotating arm, which measures 6 inches from the center of one spark electrode to the center of the other. This arm is a brass casting, the pattern for which the writer constructed in about three hours.

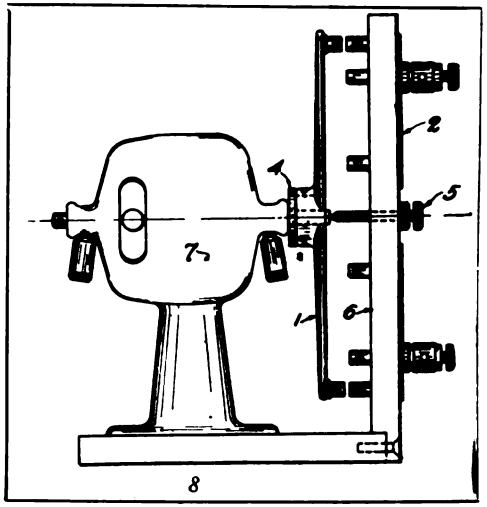


*Fig. 2, Fourth Prize Article*

Detail No. 2 shows the brass ring, which connects the spark points together. These sectors are 3/8th of an inch in width and 1/16th of an inch in thickness.

Detail No. 3 shows one of the spark electrodes of which there are ten in all, spaced evenly on a circle 6 inches in diameter. The plugs are 1/4 of an inch in diameter and 3/8th of an inch in length.

Referring to Fig. 2, detail No. 4 is a fibre bushing, which insulates the rotating arm from the base of the motor.

Detail No. 5 is an adjustable screw with check-nuts, which keeps the motor shaft the required distance from the stationary spark electrode and prevents excessive vibration at higher speeds. It of course also prevents the stationary and the moving electrodes from coming in

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direct contact. This feature is important as the average motor is constructed to have a considerable end play.

Detail No. 6 is a panel for holding the stationary spark electrodes. It is constructed from a piece of Bakelite, ½ inch in thickness, 7¾ inches in length and 7 inches in width. It is attached to the base by means of suitable machine screws. Care must be taken to have it in a straight, vertical position in order that there may be equal distances between the rotating arm and the spark points.

Detail No. 7 is a standard commercial direct current motor sold by a dealer in wireless telegraph apparatus. It is rated at 1/20th horsepower and has six variable speeds from 4,000 to 9,000 r. p. m., which gives quite sufficient range for the average rotary gap.

Detail No. 8 indicates the base for the complete structure, which is made of Bakelite and is ½ inch in thickness, 7 inches in length, and 5½ inches in width.

A gap constructed after this design will give longer life to the bearings of the motor than one of the usual construction. Care must be taken before putting it into service to see that there is no direct contact between the stationary electrodes and the rotating arm. The final connections from the spark gap to the condenser circuit are made by means of 2 binding posts mounted on the panel as shown.

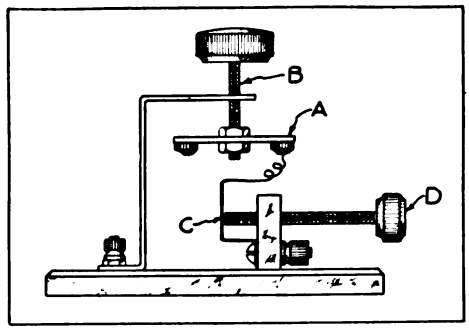
The best note is obtained from this gap by having the distance between the sparking electrodes very small, in fact, 1/50th of an inch will give the greatest value of current in the antenna circuit and the clearest note.

RALPH H. HOAGLUND, *Massachusetts.*

## HONORARY MENTION

### A Radical Dust-Proof Design for Wireless Detector

As is well known, radio detectors of the mineral type, rapidly lose their sensitiveness when they become covered with dust. A great many, of course, endeavor to overcome this by covering the instrument with a glass bell or by submerging the mineral in oil, etc. An entirely new scheme is shown in the accompanying drawing, which should prove efficient, and, as indicated, the mineral cups are placed on a brass bar or disc, A, supported by an adjustable threaded rod, B. A "cat-whisker" contact point of the usual type, may be placed on a brass spring, C, which has its tension adjustable by means of a threaded rod and knob, D, in drawing.




*Drawing, Honorary Mention Article, William Wannecke*

At first my design may seem quite impracticable, but on second thought you will see that this is just as easy to adjust as if the mineral cups were facing upwards, as in most detectors. This is because you cannot (naturally) "see" the sensitive spot on the mineral, and it must be found of course by placing the "cat-whisker" contact point on the various parts, until the most sensitive spot is ascertained, as manifested by the loudest buzzer-test signal heard in the receivers.

The base on which the detector is mounted may be of marble or of hard rubber. The drawing and the action of the adjustment are almost self-explanatory.

WILLIAM WARNECKE, *New York.*

## HONORARY MENTION

### A Method of Overcoming Trouble With Aerials

Most wireless experimenters have more or less trouble with their aerials. One evening when I was particularly anxious to receive the signals from Arlington I could not hear that station and on tracing the trouble I found that it was due to an earthed aerial. Not wishing to stop and remedy the trou-

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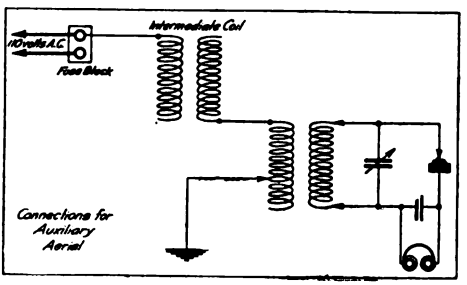
ble at night, I discovered the following method which brought Arlington much clearer than my regular 95-foot aerial had done and Cape Cod came in twice as loud as formerly. It will be worth your time to try this stunt out.

An Edison electric lighting system is the first requirement. Having brought the two sides of the Edison




*Drawing, Honorary Mention Article, Willis T. Brown*

wire in my house to a fuse block for convenience, I next found an unused spark coil and connected the secondary winding of it to the aerial binding post of my inductively-coupled receiving tuner, from which I had just disconnected the regular aerial wire. From the primary winding of the spark coil I connected a lead to one side of the electric light wires at the fuse block. By a few experimental determinations one can determine which of the wires connection should be made to; one of them will cause considerable hum in the head telephone, but the opposite one will be relatively quiet. If the connection is now moved to the proper fuse the induction is practically eliminated and the signals are strong and clear. No current is consumed by this connection as this is the side of the Edison system connected to earth.

Signals are received equally as well with any other coil that has a primary and secondary winding substituted in the circuit I have described.

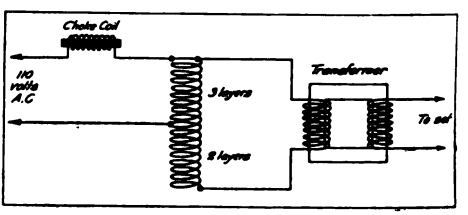
By experiment I find that if a variable condenser is used in the same manner it has the advantage over the coil in that it can be used as an auxiliary tuner. This system has proved so reliable that I have used it in preference to the usual aerial. Difference in electric wiring seems to have little importance, as I have tried this method of connection with various electrical installations in different localities, always with the same results. With a crystalline detector and a home made receiving set I have many times copied Cape Cod with my 2,000 ohm head telephones lying on the table.

WILLIS T. BROWN, *Massachusetts.*

## HONORARY MENTION

### Increasing the Efficiency of an Amateur's High Voltage Transformer

The majority of amateurs are aware of the fact that in order to be efficient their high voltage transformers should have a potential lying between 15,000 and 20,000 volts to permit the use of full power on the 200-meter wave. Many experimenters own transformers of the Blitzen type or other manufacture which only give from 5,000 to 10,000 volts at the secondary winding. I have found by experiment that it is possible to supply these tranformers with 200 volts in the




*Drawing, Honorary Mention Article, Paul D. Flehr*

primary without danger of burning them out. The necessary potential is obtained by constructing an auto transformer consisting of an iron wire core two inches in diameter, twelve inches in length, wound with five layers of No. 14 or No. 12 cotton covered wire with a tap taken out on the third layer. This is then connected to the transformer proper as shown in the accompanying drawing. A choke or a reactance coil must be connected in series with the 110-volt line to regulate the flow of current.

I find that by this method transformers may be safely overloaded without heating.

PAUL D. FLEHR, *Ohio.*

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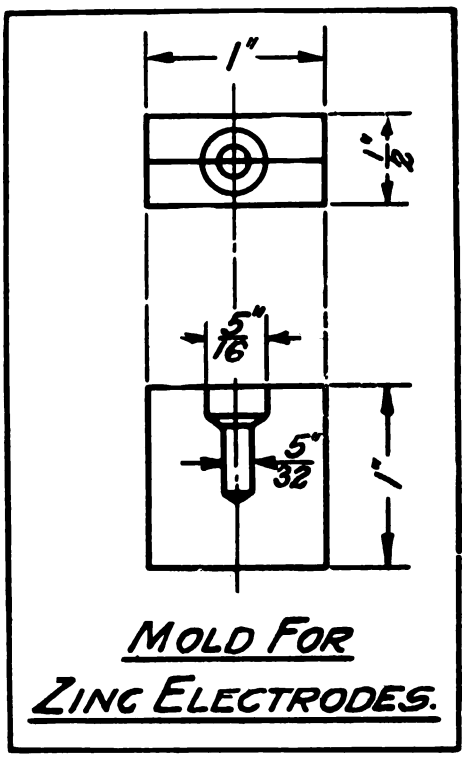



*Drawing, Honorary Mention Article, F. W. Nunenmacher*

## HONORARY MENTION

### A Mold for Casting Rotary Spark Zinc Electrodes

A mold for casting zinc electrodes for a rotary spark gap is easily made from a small piece of wrought iron. The iron is cut to the desired size and drilled as shown in the drawing. It is then sawn in half lengthwise whereupon it may be held tight in a vise or a clamp for the pouring. When the melted zinc is being poured, care should be taken to see that the mold is level and that both sides line up evenly.

After a sufficiently number of electrodes have been cast for a given gap, an 8/32 inch die should be run over the smaller ends, and the rough edges should be taken off the remainder by means of a fine file. The electrodes designed after the accompanying sketch work very well indeed and have also been used as switch points in a multipoint switch.

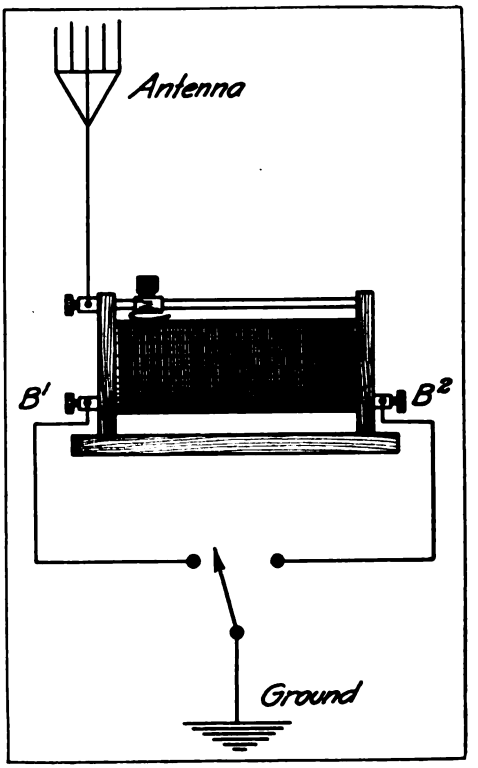
FRANCIS W. NUNENMACHER, *California.*

## HONORARY MENTION

### Making Use of All the Turns in a Tuning Coil

A two-slide tuning coil which I have been using at my receiving station, was so constructed that the sliding contact would not permit the operator to reach the last turn of inductance. The difficulty was overcome by fitting both ends of the coil with a two-point switch, as indicated in the accompanying drawing. It is plainly evident that the B' end of the coil cannot be reached by this slider, but by throwing the small switch to the right, the B-2 end can be touched to the last turn.

RALPH B. BEAUMONT, *California.*




*Drawing, Honorary Mention Article, Ralph B. Beaumont*

## HONORARY MENTION

### Directions for Preventing Trouble With Phone Cord

The unavoidable bending back and forth of the telephone cords at the point where the cord enters the metal tip, in a short time causes the tinsel

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wires to part within the insulation, leaving a defective or completely broken circuit, the source of which is not easily ascertained. The amateur will often blame his detector, or the receiver, and will examine every connection on his set, but seldom does he trace the trouble to faulty telephone cord.

To eliminate all future possibility of trouble of this sort, it is only necessary to follow my suggestion. Obtain 12 inches of small rubber tubing (not more than 3/16 inches in diameter) and cut it into six pieces, each two inches long. Slip a piece of rubber over each of the cord tips. This can be done without removing a tip as the smaller tubing will stretch and when in place should fit snugly over the cord and the end of the metal tip.

When the cord is thus fitted, the bending which formerly took place at the joint of the tip and cord will now be evenly distributed over several inches of its length and the life of the cord will be more than doubled.

WALKER S. KRAINKA, *Missouri.*

## HONORARY MENTION

### An Adjustable Sending Condenser for Spark Coils

My experiments reveal that spark coils of different construction require condensers of different values of capacity. It is also a well known fact that the capacity of the condenser in shunt to the secondary winding must vary with the speed of interruption of the vibrator. Many amateurs are accustomed to use a capacity of .002 microfarad in shunt to the secondary winding, but in some of my experiments I found this value to be excessive.

With the condenser I am about to describe, one can get any desired value of capacity in a simple manner. The condenser is suitable for a ½-inch or 1-inch spark coil. It will be found to be of considerable value to the experimenter who changes the dimensions of his aerial frequently.

Referring to Fig. 1: The glass tube is 8 inches long, 1⅞ inches outside diameter, 1/16th of an inch in thickness. This tube is covered with tinfoil on the outside for a distance of 4 inches, the

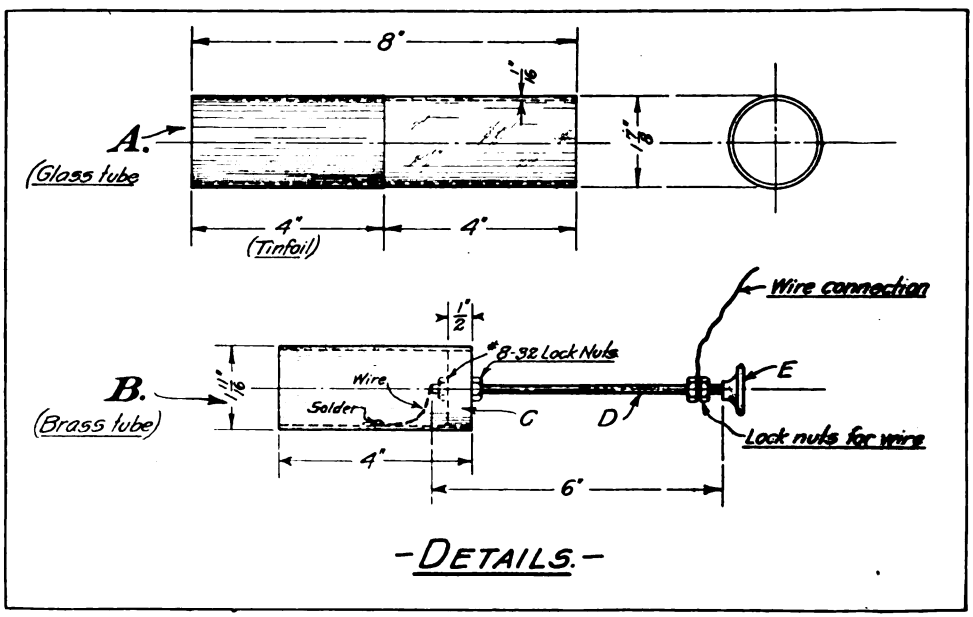


*Fig. 1, Honorary Mention Article, Newton W. Weeller*

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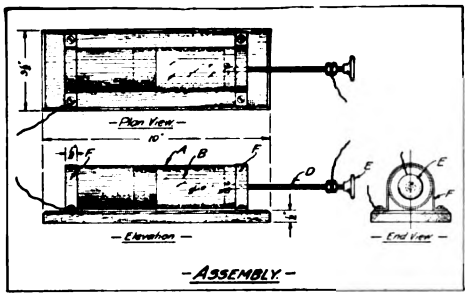


*Fig. 2, Honorary Mention Article, Newton W. Weeller*

remaining space being left clear. For the inside surface of the condenser a brass tube, B, is employed, which is 4 inches in length, and a trifle less than 1¾ inches in outside diameter. A tube of any thickness is suitable, but care should be taken to have it move freely in and out of the glass tube.

A wood plug C, is placed at the end of the tube, B, and cut to make a snug fit. An 8/32 inch brass rod passes through the center of C, and is threaded for a distance of ¾ inch to take 2 lock nuts for holding the rod, B. The latter is 6 inches in length. At the opposite end of D a thread is cut for a distance of 1 inch, which is fitted with 2 additional lock nuts to which the flexible wire is attached. A hard rubber knob, E, of any convenient size is mounted at the extreme end. To make connection with B, a wire is soldered on the inside of D and then fastened to the lock nut on the inside of the plug, C.

The base for this condenser may be 10 inches in length, 3 inches in width and ½ inch in thickness. Practically any kind of wood will do that is dry and possesses sufficient insulating qualities for high potentials. The entire condenser may be fastened to the base by means of brass strips, as at F, one strip being placed at each end of the tube. The connection to the tinfoil will be made by means of a wire fastened under the screw which holds the brass straps in place. When completed, the tinfoil is connected to one side of the spark gap and the opposite electrode of the gap is connected to the lock nuts near the hard rubber handle, E.

NEWTON W. WEELLER, *New York.*

## HONORARY MENTION

### Linking Circuits Adapted to Receiving Transformers

The linking circuit, as described in THE WIRELESS AGE by E. E. Butcher, may be applied to inductively coupled receiving transformers as well as to "straight tuners."

A few turns of insulated wire, such as No. 20 silk rubber insulated lamp cord, are wound about both primary and secondary, and connected together. For convenience in using, these coils should be wound on tubes of cardboard or other material, of such diameter as to permit their being moved easily over the primary and secondary windings, in order that their respective couplings may be varied. In operation the secondary of the transformer is drawn clear of the primary; there should be as much space between primary and secondary as possible, so as to avoid direct inductive action between the original windings. The number of turns employed in linking circuit is best found by experiment.

In case the variation of primary inductance is accomplished by means of taps taken from outside of winding, it will be impossible to use a sliding tube over same, and the linking coil will have to be wound directly about the primary in the best position for average working.

All circuits to the transformer remain as before and the number of turns employed in both windings will generally be the same as in the usual method.

Fairly good results may be obtained. If the set be rendered less efficient, the loss will probably be due to usual losses of transformation. The increased selectivity obtained surely repays one for the trouble in making.

H. N. UMBARGER, Michigan.

## TELEPHONE COMPANY ADOPTS WIRELESS AUXILIARY

The Pittsburg-Allegheny Telephone Company had its poles and wires wrecked last winter by the sleet. Owing to the trouble then experienced in repairing the lines, an emergency wireless system with eight branch stations has been installed.

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## OPERATING UNDER ADVERSE CONDITIONS

A severe electrical storm swept over Illinois, Ohio, Indiana and Pennsylvania on April 12. The static conditions were so bad that my vacuum valve detector was continually polarized and several Ohio amateurs later informed me that sparks were leaping the anchor gap from their aerial wires to the ground. It was raining hard in Chicago when I was scheduled to start the first message over the new American Radio Relay League's new cross-continent route. I gave my test message to 8NH (Mrs. Charles Candler, St. Marys, Ohio), 200 miles away and received her O. K. on it without difficulty. I later received a letter from her in which she said:

"I received your message through the worst static I ever tried to work through. At times the interference from this source was so loud as to make it uncomfortable to wear the head telephones. Nevertheless, I was able to copy your signals without much difficulty."

I worked 8AEZ at Lima, Ohio, on April 8 through a warm rain for one hour and a half without a single repeated word. I took down two messages from him and then worked 9PC at Fort Wayne, Ind., for three-quarters of an hour and took two messages from him and dispatched one to him. I received a letter next day from 9EP, at Kansas City, 425 miles away, saying that he had copied everything I sent out with a silicon detector.

I am in receipt of a letter from 2IC (A. J. Faraon, New York City), saying that he receives my signals at present much louder than he has ever heard them before. He refers particularly to my working 9GJ of St. Louis, Mo., on the evening of April 15, and says he received my signals through very heavy static.

A. C. Campbell (7BD) of Lewiston, Mont., declares that he often hears my signals very loudly. It should be taken into consideration that his station is 1,300 miles distant from mine with an intervening mountainous country.

I do not know whether or not this long distance work will continue throughout the summer months, but I can state that at this writing long distance stations are heard just as loud at my station as at any time during the winter. I have never had a chance to try summer work because of the fact that I am a wireless operator on one of the boats on the Great Lakes during the summer months and do not have an opportunity to operate my own set. However, last summer, while on the steamer Arizona, I frequently heard 8-NH and 8-AEZ using a galena detector. I shall attempt to make some long distance amateur records during the summer months and will inform you of the results.

R. H. E. MATHEWS, *Illinois.*

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## LONG DISTANCE WORK IN WISCONSIN

In reference to the articles by R. H. E. Mathews, N. B. West and Mrs. Charles Candler in THE WIRELESS AGE, I feel safe in saying that these reports are in every way true. In Wisconsin the amateurs have had wonderful results with long distance work. 9SP, 9DB, 9IC and 9BV, who are in my locality, consider it not uncommon to communicate with Mrs. Charles Candler (8NH) and N. B. West (8AEZ). I have interchanged signals with 9BD at Superior, Wis., a distance of 350 miles, with ½ k.w. set for periods of one hour at a time, using a galena crystal detector and in addition I hear amateurs throughout the Mississippi valley, including 5BJ in Dallas, Tex. Have heard 8AEZ twice as loud as nearby 2 k.w. commercial stations. Have communicated with 9LT in St. Louis and have heard 2JD in New York City for nights running a week or more, so do not consider the results a matter of luck or of freak conditions. As to summer conditions, I will not speak so strongly, but I have worked 9IK and 9KU in Chicago in midsummer and afternoons the year round.

I hope these letters will give other amateurs more confidence in the range of their sets and that they will "stand-by" and be more alert in long distance communication.

RICHARD J. OETJEN, *Wisconsin.*

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# Queries Answered

Answers will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all letters and only one side of the paper written on; where diagrams are necessary they must be on a separate sheet and drawn with India ink. Not more than five questions of an individual can be answered. To receive attention these rules must be rigidly observed.

**Positively no Questions Answered by Mail.**

G. G. C., Grosse Point, Mich., inquires:

Ques.—(1) What make of transformer (1 kw.) would you recommend as the best type for amateur use? The closed core type is preferred.

Ans.—(1) The transformers sold by the advertisers in this magazine are reliable and operate satisfactorily. A transformer of the closed core type should be constructed to have a certain amount of magnetic leakage; lacking this feature it will possess undesirable operating characteristics for wireless telegraph use.

Ques.—(2) Upon widening out the spark gap of a small induction coil, a larger value of current is obtained in the antenna circuit than when the spark is discharging. Why is this?

Ans.—(2) This would seem to indicate that the insulators of the antenna are leaking badly and when the gap is widened out beyond the sparking distance the energy from the secondary winding of the induction coil possesses a greater current value than that obtained by the discharge of the energy stored up in the antenna. Try fitting the aerial with a new set of insulators.

Ques.—(3) What is the lowest possible cost of a 1 to 1 auto transformer and where can one be purchased?

Ans.—(3) Coils of this type can be purchased from the Manhattan Electrical Supply Company, New York City, at a cost of $12 each.

Ques.—(4 ).The other night I believe I heard NAJ (U. S. Naval Station, Lake Bluff, Ill.) operating with a spark gap. If I am correct, do you know what value of power is used?

Ans.—(4) We have not been advised that this station is equipped with spark apparatus, but we do know that it employs generally a 30 k.w. arc set. Further information concerning this station can be obtained from the Superintendent of Radio, Radio, Va.

* * *

B. H. M., Fort Monroe, Va., inquires:

Ques.—(1) About what frequency of interruption do vibrators of the type generally used in connection with the induction coil sets of the United States Signal Corps give? They are operated on an 18-volt storage battery.

Ans.—(1) These interruptors give from 50 to 100 breaks per second on the larger size sets and in the case of smaller induction coils, interruptions as high as 180 per second are obtained. Independently operated, magetic interruptors generally give a low speed of interruption, approximately 40 per second.

Ques.—(2) In the usual type of vibrating coil radio sets, open core transformers are employed. What would be the operating characteristic of these sets if supplied with alternating current at the same frequency and voltage?

Ans.—(2) If the precaution is taken to keep the A.C. voltage down, certain of these induction coils may be operated on alternating current as well as upon direct current. The usual induction coil constructed for operation on direct current has too much self-inductance in the secondary winding for alterating current and too little inductance in the primary winding. With certain types of coils it is possible to rearrange the design and to give the primary winding a greater value of inductance by the addition of one or two layers. The inductance of the secondary winding, of course, can be reduced by the removal of a portion of the pancakes.

Ques.—(3) Would the transformer be more efficient supplied with a higher frequency, say 100 cycles?

Ans.—(3) As far as the primary winding is concerned, better results would be obtained from the higher frequency, but the secondary winding still has too many turns for alternating current.

Ques.—(4) With the same value of coupling between the primary and secondary windings of a receiving tuner which gives the greater selectivity, tuning the receiving set by capacity or by inductance? Which gives the sharper tuning?

Ans.—(4) An increase of capacity in a radio frequency circuit has the effect of increasing the decrement. An increase of inductance, on the other hand, decreases the decrement at least up to a certain point. If abnormal values of inductance are added in the circuit the resistance is increased to such an extent that the good effects of inductance are overbalanced. The sharpest selectivity



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is obtained in the secondary circuit by variation of the inductance value, but owing to the fact that the usual secondary switch is connected to groups of the turns of the secondary winding it is necessary to use a variable condenser to secure close variation of the wave-length between the taps of the inductance switch. When loose coupling is employed between the primary and secondary windings of a receiving tuner, the greatest selectivity is obtained in the secondary winding by the use of capacity in shunt to that winding, but under conditions of tight coupling this condenser is a detriment to the strength of signals. In the antenna circuit an increase of inductance has the effect of reducing the decrement of the received energy, making it less difficult to separate interfering stations. In instances where the natural wave-length of the antenna is of such value that but a few turns are required at the primary winding of the receiving tuner to place it in resonance with the distant transmitting station, increased selectivity can be obtained by placing a condenser in series with the antenna circuit, thereby reducing its wave-length; the wave-length of the circuit is brought back to normal value by the addition of inductance in the antenna circuit. Owing to the fact that the total capacity of the antenna system is decreased and the inductance value increased, a greater degree of selectivity is obtained. This subject is discussed in the book "How to Conduct a Radio Club," published by the Marconi Publishing Corporation.

* * *

R. P. P., Newark, N. J., writes:

Ques.—(1) In the book "How to Conduct a Radio Club," Figs. 2 and 3 are facsimiles of my set. Would these two drawings be acceptable in the examination for a government license?

Ans.—(1) In the examination for an amateur first grade certificate these diagrams would probably be all that is required, but in the examination for an operator's first grade certificate a more complete drawing, one showing the circuits of motor generators, starting boxes, etc., is necessary. Satisfactory wiring diagrams are given in the book "How to Pass the U. S. Government Wireless License Examinations."

* * *

H. F. M., Jr., Cleveland, Ohio, inquires:

Ques.—(1) I read that the leyden jars used in commercial wireless telegraph sets were made of flint glass coated with copper by an electrolytic process. Inasmuch as glass is a non-conductor of electricity I do not see how this could be possible. Any information on the subject that you can give me would be greatly appreciated.

Ans.—(1) There are two processes by which a leyden jar can be coated with copper. One is to first cover the inside and the outside jar with a cold silver solution similar to that used on the rear of mirrors. The jar is then placed in a furnace and heated almost to the melting point. At this stage of operation the jar is removed from the furnace and allowed to cool slowly, whereupon it will be found that the silver is thoroughly burned into the glass. Since the glass now possesses a silver coating inside and outside it is only necessary to place it in an ordinary electro-plating vat and give it a good coat of copper. Another method is to coat the inside and outside of the jar with a paste made of graphite and shellac. The graphite possesses a sufficient degress of conductivity to allow the electro-plating process to take place. The first method described is the superior one.

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P. O. C., Middletown, Md.:

Your aerial, 170 feet in length with an average height of 45 feet, is apparently well designed and the disposition of the lead-in will in no wise interfere with its overall efficiency. The wave-length of the aerial is approximately 320 meters—the correct value for the reception of signals at wave-yengths of 500 to 600 meters. For the dimensions of a receiving tuner suitable to this aerial you are referred to the article "How to Conduct a Radio Club" in the May, 1916, issue of THE WIRELESS AGE. Complete dimensions were given for receiving tuners of various sizes for various ranges of wave-lengths. The article should be carefully studied.

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L. B., Albion, Mich.:

Your 150-foot aerial with an average height of 50 feet has a natural wave-length of approximately 381 meters.

We advise you to study the wireless situation carefully before you begin the construction of a 25,000-meter tuner because there are no stations in the world that operate at this wave-length, nor is it proposed to operate any stations at this wave-length so far as we are aware. The longest wave-length used by any commercial station at the present is that of a wireless telegraph company at Honolulu, which occasionally operates at the wave-length of 12,000 meters. If, after having taken these facts into consideration, you still wish to construct the 25,000-meter tuner you are advised to purchase a copy of the book "How to Conduct a Radio Club" wherein is described the complete circuit for a receiving tuner responsive to wave-lengths of 10,000 meters inclusive. If you will then increase the dimensions of these coils, making them approximately four times their present length, or double the size of the coils and use variable condensers of larger capacity, you will have a receiving set adjustable to the wave-length of 20,000 meters. But after you have completed this apparatus there will be no stations to receive from and consequently it will be useless.

Regarding your third query: The difference between damped and undamped oscillations is so completely described in text books on wireless telegraphy that it hardly

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seems necessary to go over the matter again in this department. In a previous issue of THE WIRELESS AGE the facts and reasonings concerning this subject have been fully stated. It is also somewhat exhaustively discussed in Zenneck's "Wireless Telegraphy" and "The Text Book of Wireless Telegraphy," by Rupert Stanley.

The Arlington station uses both damped and undamped oscillations. The undamped oscillation set comprises an arc generator of 60 kw. capacity which is operated at wave-lengths between 6,000 and 7,000 meters. The damped set is of 100 kw. capacity and operates at a wave-length of 2,500 meters. There is also a small set used for short distance communication which operates at a wave-length of 1,000 meters.

* * *

J. A. O., Nephi, Utah.

It is rather difficult to diagnose your difficulties and those of your friends without being on the ground, but certainly a 1-inch spark coil in connection with an aerial of the dimensions you give should permit the transmission of wireless telegraph signals to a distance of one-half mile. However, it seems from your explanation that you receive better results from electrostatic induction than by the radiation of wireless telegraph energy. The signals your friend receives by means of a head telephone without a crystalline detector are merely those set up by electrostatic induction from your aerial and there is no reason why, if your set is properly set up, that you should not cover the desired distance. Both receiving sets are rather ill-proportioned for the work you require and it would be of benefit to study the diagrams in the book "How to Conduct a Radio Club" and also note particularly the article on "How to Conduct a Radio Club in the May, 1916, issue of THE WIRELESS AGE. A defect frequently found in amateur stations is due to the fact that the receiving tuners are designed for a wide range of wave-length and the majority of them do not have a small enough value of inductance to permit the circuits to be adjusted to the wave-length of 200 meters. In the book: "How to Conduct a Radio Club" a portable receiving set, specifically designed for the reception of signals at a wave-length of 200 meters, is described, and you would do well to purchase a copy and study it carefully. A 1-inch spark coil should transmit to a distance of five miles with little difficulty, and under more favorable conditions to a greater distance.

It is difficult for us to advise concerning your troubles with the electrolytic interruptor, but you had better write to the makers of this device. It is probable that you have not the correct proportions of acid to water in the solution, or that the primary winding of your induction coil has a very low value of resistance and therefore consumes an abnormal current. Remember that the electrolytic interruptor will only function at potentials above 80 volts and gives better results on direct than on alternating current. The diagram of connections you have furnished is quite correct and should give response from other amateur stations.

In our opinion the filings detector will give better results than the electrolytic detector made by another concern.

* * *

A. H., Little Rock, Ark., Inquires:

Ques.—(1) Considering the cost, what kind and size of wire would be best for a single-strand 3,000-foot aerial?

Ans.—(1) This span is rather unusual and we fear that you will require a heavy stranded copper cable which will have to be very strongly supported in order to stand the strain to which it will be subjected. Ordinary aerial wire certainly will not do and since you state that you desire this for long distance work we advise you that an antenna of this length is not apt to be required. High-power stations here and abroad can be heard with aerials 1,000 feet in length.

As you state in your second query, steel piano wire is very strong and will probably stand the strain. Of course, it possesses a lower degree of conductivity than copper wire, but if the cable is made up of several strands we believe that it will possess sufficient conductivity for the purpose.

The natural wave-length of the aerial which you inquire about in your third query will be approximately 4,600 meters. It will show directional effects and probably will respond best in the direction opposite to the free end.

Either of the transmitting sets referred to in your fifth query will give good results and the antenna current to be obtained in both cases is about equal. Many amateurs prefer the rotary quenched type of transmitting apparatus.

* * *

F. C. P., Sharpsburg, Pa., inquires:

Ques.—(1) Please give the dimensions for an inductively-coupled receiving tuner to be adjustable to wave-lengths between 7,000 and 11,000 meters. The secondary winding is to be used with a condenser of .0001 microfarad in shunt, in connection with the vacuum valve detector.

Ans.—(1) The secondary winding for this tuner should be 20 inches in length, 8 inches in diameter, wound closely with No. 34 S. S. C. wire. Shunted by the condenser of .0001 microfarad it will give the desired range of wave-lengths. It is difficult to give the dimensions for the primary winding without the dimensions of the receiving aerial with which it is to be used, but in the article on "How to Conduct a Radio Club," appearing in the May, 1916, issue of THE WIRELESS AGE, you will find the dimensions for primary windings for aerials of definite dimensions.

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Ques.—(2) Please give the possible wave-length adjustment of the primary and secondary windings of the following described tuner in connection with a two-wire aerial 140 feet in length, 40 feet in height, with a lead-in 10 feet in length. The primary winding of the receiving tuner is 5½ inches in length, 5¼ inches in diameter, wound closely with No. 24 B. & S. S. S. C. wire. The secondary winding is 6 inches in length, 4⅝ inches in diameter, wound closely with No. 30 B. & S. S. S. C. wire. It is shunted with a variable condenser of .0001 microfarad capacity.

Ans.—(2) The inductance of the aerial is approximately 60,670 centimeters, the capacitance about .0005 microfarad, and the natural wave-length approximately 325 meters. The secondary winding, with a capacity of .0001 microfarad, will respond to wave-lengths of about 2,300 meters. The primary winding connected in series with the aerial described will permit adjustments in that circuit to wave-lengths of about 2,800 meters.

Referring to your third query We cannot calculate the wave-length of a spiral aerial and we see no advantage in using one of this type.

Ques.—(4) I have seen the published statement to the effect that the life of a vacuum valve bulb is extremely short when used in amplifying an undamped wave circuit because the filament must be burned at excessive brilliancy. Is this a fact?

Ans.—(4) The statement is not quite correct, for with the proper amplification circuit the vacuum valve can be burned at a degree of incandescence below the characteristic blue glow point. Hence the filament will last quite as long as in the ordinary type of vacuum valve circuit. If, however, the bulb is used at a degree of incandescence where a considerable blue glow is evident, then the filament will disintegrate rather rapidly.

We advise you to use a straight-away aerial in place of the proposed spiral aerial referred to in your fifth query. It is preferable to have either the receiving or transmitting aerial as nearly uniform as possible. No advantage is derived from coiling the wire up.

* * *

C. P. D., Statesville, N. C., inquires:

Ques.—(1) Does the height of an aerial have any effect on the amount of static accumulating in the receiving apparatus? I have an aerial 45 feet in height and I am continuously bothered with what I believe to be atmospheric electricity, but a friend of mine, whose station is located just a block away has an aerial 70 feet in height at one end and 50 feet at the other, and he rarely hears static.

Ans.—(1) Usually the higher the aerial the greater will be the effect of atmospheric electricity, but in your case it is likely that you are receiving induction from power or telegraph lines rather than from atmospheric electricity. If your trouble is due to local induction, it is difficult to eliminate. Usually it can only be overcome by completely removing the receiving aerial from near-by power wires.

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J. B. K., Los Angeles, Cal., inquires:

Ques.—(1) Does a crystalline detector amplify the current received from a distant transmitting station or does it really act as a conductor?

Ans.—(1) If the crystal is one of the type employing a local battery, the signals from the distant station are amplified, but where the telephones are operated merely by the antenna energy, then the crystal detector does not amplify the incoming signals; in fact, it reduces their strength. You of course understand that the crystal is employed merely to make the signals audible and does, as you state further on in your query, rectify the alternating current in each group of oscillations into a series of direct current impulses of constantly decaying amplitude.

* * *

H. J. H., Los Angeles, Cal., writes:

Ques.—(1) I have a 4-wire aerial of the inverted L type and would like to know if it is of the correct dimensions for operation at the wave-length of 200 meters. The flat top portion comprises four wires, spaced a little over 5 feet apart and is 83 feet in length, 65 feet in height at both ends, and is constructed of No. 14 copper wire.

Ans.—(1) The fundamental wave-length is about 270 meters, which is of excessive value for operation on the wave-length of 200 meters.

Ques.—(2) What would be the wave-length of this aerial if the lead-ins are attached to the center of the flat top portion?

Ans.—(2) The fundamental period will be about 180 meters, the correct value for operation at the wave-length of 200 meters.

Ques.—(3) What is the efficiency of the open core transformer of 1 k.w. capacity, described on page 32 of the book "How to Conduct a Radio Club"? What is the size of the secondary wire and what potential may be expected when the primary winding is connected to 110 volts a.c. mains?

Ans.—(3) This transformer represents an efficiency of about 75 per cent. and the secondary voltage will be about 20,000 if the secondary winding is made of No. 32 single cotton covered wire.

Ques.—(4) How many glass plates, 12 inches by 18 inches, with a thickness of 1-16th of an inch, are necessary for a condenser suitable to this transformer?

Ans.—(4) For operation at the wave-length of 200 meters the capacitance should be about .008 microfarad for the complete condenser. If the 12 by 18 plates are covered with foil, 10 by 6 inches, then four plates connected in parallel will give the required value of capacity, but owing to the potential of the transformer a parallel connection of plates will not be able to withstand the potential; in consequence you must use a series parallel connection, that is, eight plates should be connected in parallel in each bank and the two banks finally connected in series.

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F. M. B. Clinton, Ia., writes:

You will note by the drawings attached to my query that I contemplate erecting two aerials on a single set of masts. The first aerial is to be 100 feet in height at one end and 40 feet in height at the other and the flat top portion is to consist of 2 wires 100 feet in length. Immediately underneath this I intend to erect another aerial, 55 feet in length, composed of four wires spaced 2 feet apart. It will be about 75 feet from the earth at one end and approximately 35 feet at the other. The small aerial is of course to be used for sending at the wave-length of 200 meters, while the large aerial will be used for the reception of signals at wave-length of about the value of 6,000 meters. Will this sending aerial exceed the Government restriction of 200 meters when connected to a ¼ k.w. transmitting set? Also, what is the fundamental wave-length of each of these aerials?

Ans.—(1) The larger aerial will have a fundamental wave-length of approximately 300 meters and the smaller one 180 meters. You will thus see that the smaller aerial is of the correct dimensions for operation at the wave-length of 200 meters and if you connect a good sensitive receiving set to the larger aerial you will experience no difficulty in copying signals at the wave-length of 6,000 meters. You, of course, require a supersensitive receiving set like that described in the book "How to Conduct a Radio Club."

* * *

W. L. O., New York City:

You should purchase a copy of the book "How to Conduct a Radio Club" and construct a long distance receiving set after the designs given therein. The aerial you mention, 100 feet in length by 55 feet in height, is feasible for the reception of long distance signals with the Armstrong receiving circuit and should give fair results. The fundamental wave-length of your aerial is about 290 meters.

* * *

H. A. T., Jr., Hyde Park, Mass., inquires:

Ques.—(1) Please give full information concerning the power, insurance and electric light regulations for the installation of a ¼ k.w. Blitzen set. May I connect the transmitting apparatus directly to a house lamp socket, provided a kick-back preventer is employed? Is it required that a separate line be run from the meter?

Ans.—(1) There is a slight variation of the Underwriters' code in various cities, but generally it is required that a separate power line be installed from the meter to the wireless telegraph apparatus, the circuits for which must be run in iron conduit, flexduct, or in certain localities, armored cable (lead covered) is permitted. No. 12 single braid, rubber covered wire should be employed for connecting up the primary circuit. It is generally the requirement that the antenna wires be connected to earth through a 100 ampere lighting switch, the earth connection being made of No. 4 D. B. R. C. wire. The earth connection must be insulated from all buildings or supports until actual contact is made with the earth and this connection, if attached to the water main, must be made on the street side of the meter. Care should be taken to insulate the outgoing wires from the transmitting apparatus to the aerial through high potential insulating bushings that will withstand the potential of the transmitter in wet weather.

Ques.—(2) Where can I procure a diagram for connecting up a double vacuum valve as an amplifier?

Ans.—(2) A complete set of diagrams is given in the book "How to Conduct a Radio Club."

* * *

A. W. J., Warren, Pa., inquires:

Ques.—(1) Is it possible to calculate the wave-length of a 6-wire aerial, 100 feet in length, the wires spaced being 2 feet apart? It is 48 feet in height at one end and 30 feet in height at the other.

Ans.—(1) The fundamental wave-length is approximately 250 meters.

Ques.—(2) How could I shorten this aerial so as to comply with the law?

Ans.—(2) If possible, the better way to do is to attach the lead-in wires to the center of the flat top portion. The fundamental wave-length will then be about 165 meters.

Ans.—(3) We can give no information regarding the relative sensibilities of various types of vacuum valves. A certain type of 3-element vacuum valves vary widely in sensibility, but the bulbs exhausted to a high degree, generally show practically equal degrees of sensitiveness.

Ans.—(4) A limited number of back copies of the Bulletin of the National Amateur Wireless Association can be obtained of the Association, 450 Fourth avenue, New York City.

The electrical symbol indicated in your fifth query represents a variometer, which is a device for variation of the inductance value in an oscillatory circuit by means of two concentric coils connected in series. In one position the inductance is maximum and in the opposite concentric position the inductance is at a minimum.

Your query regarding the number of Murdock condensers to be used with a one-inch coil cannot be specifically answered, because the designs of spark coils vary widely and the actual value of capacity is, to a great extent, dependent upon the ability of the interrupter. Ordinarily a single section of this condenser will be quite sufficient. Perhaps better results will be obtained by connecting two units in series. You can easily determine for yourself when you have the correct number of turns in the primary winding of the oscillation transformer for obtaining the wave-length of 200 meters. You may erect an antenna having a natural wave-length of close to 200 meters and then place a small glow lamp or hot wire milli-ammeter in series with the aerial circuit. The primary winding should be made up of at least a dozen or fourteen turns of double braided rubber covered wire, No. 6 or No. 8, and taps off taken from each turn. Then when the spark is set into operation, the inductance value of the primary winding may be altered until the aerial current indicating instrument shows the highest reading. The two

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circuits are then in resonance and will give the highest possible degree of efficiency.

* * *

V. S. (no address given) writes:

Ques.—(1) If the wave-length of a circuit equals 59.6 $\sqrt{LC}$, how is this formula applicable to finding the wave-length of the secondary winding of a receiving coupler when a variable condenser is not employed in shunt.

Ans.—(1) To carry out the calculation we must assume a certain amount of distributed capacitance between the turns of the winding. For purposes of calculation we may use a rather high value, namely, .0001 microfarad. We substitute this value in the formula you have denoted and the result is the value of wave-length near to which the secondary winding is adjustable. If you consider .0001 microfarad rather high for the value of distributed capacity, you may use the value .00005 microfarad. The usual receiving tuner, however, has a condenser in shunt to the secondary winding and if the capacitance of it is known at various degrees of the condenser scale it is easy to compute the wave-length of the circuit.

The formula for obtaining the possible wave-lengths adjustment of an antenna system when the primary winding is shunted by a variable condenser is rather complicated and would require too much space to be taken up in detail in this department. However, with inductance coils only, it is a simple matter to calculate the upper and lower range of wave-length adjustment of an aerial system. It is apparent from your communication that you already understand the method of calculation.

Ans.—(3) You do not require a step-down transformer for an electrolytic rectifier. It may be operated direct from a 110-volt source of current supply and if a parallel connection of incandescent lights is employed in series with the 6-volt, 40-ampere storage cell, the current flow can be carefully regulated. The manufacturers of the electrolytic rectifier will without doubt furnish you a satisfactory diagram of connections.

Ques.—(4) Would the strength of received signals be increased if a small potential were applied to the galena and silicon detectors?

Ans.—(4) Yes; provided the potentiometer is one that allows an extremely close variation of the current value and permits it to be reduced to a very small fraction of a volt. The ordinary potentiometer to effect this requires a fixed resistance of about 2,000 ohms connected in series with the potentiometer and a single dry cell. To say the least it facilitates the adjustment of silicon and galena detectors to apply a small potential, but care must be taken to have the polarity of the battery correct. The proper direction of current flow can easily be determined by a few experiments.

Ques.—(5) Should the formula $C \frac{W}{NV^2}$ be employed to determine the capacitance of a condenser for a given transformer?

Ans.—(5) The formula is quite correct, but must be modified for commercial practice. It does, however, give an approximation of the condenser capacity and is highly valuable for simple calculations.

E. E. L., Bridgeport, Conn., inquires:

Ques.—(1) Concerning the undamped wave receiving set, described on page 94 of the book "How to Conduct a Radio Club," should the detector connection to the coil L-1 be adjustable?

Ans.—(1) It may result in a slight increase in the strength of signals to have it adjustable when the tuning coil is not in exact resonance with the transmitting station.

Ques—(2) Is this system as a whole very efficient?

Ans.—(2) It gives fair results from nearby stations, particularly those employing the arc type of generator. Results not so good are obtained from the high frequency alternators.

Ques.—(3) What is the derivation of the equation

$$\lambda = 59.6 \sqrt{LC}$$

Ans.—(3) It was derived from the formula

$$\lambda = V\ 2\pi \sqrt{LC}$$

Where $\lambda$ = the wave-length of an oscillatory circuit in meters, V = the velocity of propagation of an electric current or electro magnetic waves in ether, or N = 186,000 miles per second.

L = the inductance of a circuit in henries.

C = the capacitance of the circuit in farads.

If the value V is converted from miles to meters, then the formula becomes

$$\lambda = 1.885\ V\ LC.\ 10^9 \text{ meters.}$$

Now, if L is converted into centimeters (one-billionth of a henry) and C is converted to microfarads (one-millionth of a farad) then if you understand the solving of an equation you will see that

$$\lambda = 59.6 \sqrt{LC}$$

* * *

A. G., Los Angeles, Cal., writes:

Ques.—(1) I have the core for a closed core transformer that measures 8 inches in length, 5 inches in width, with the sides 1 inch square. I would like to use this for wireless telegraph purposes and desire to know the size of wire to be placed on the primary and secondary windings and approximately the number of pounds or ounces required.

Ans.—(1) The core is rather small for a transformer of ¼ k.w. capacity, but it may give fairly good results with about 150 watts consumption in the primary circuit. The primary winding should have fifteen layers of No. 16 D. C. C. wire, which weighs approximately 3½ pounds. The secondary winding should be made of No. 34 enameled wire, divided into seven sections, and will weigh totally about 8 pounds. For short distance transmitting work this transformer should give good results.

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G. E. P., McKinney, Tex.:

An aerial 30 feet in length, 20 feet in height, is not apt to give good results in radio telegraphy and probably will do no more than permit the reception of signals from local amateur stations; you cannot expect to do long distance work with it. The apparatus you have described is efficient for amateur work and if properly connected will permit the reception of signals for a distance of 100 miles from high power stations. You should, if pos-

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sible, erect an antenna of increased dimensions, making the flat top portion at least 50 or 60 feet in length.

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R. F., Lewiston, Pa.:

From the data given in the article on "How to Conduct a Radio Club" in the May 1, 1916, issue of THE WIRELESS AGE, you should have no difficulty in selecting a receiving tuner winding that will respond to the wave-length of 4,000 meters. We believe that by careful reading of this article you will be able to construct a receiving tuner that will be highly suitable for your purpose.

* * *

G. S., Melrose, Mass.:

An inductively coupled type of receiving apparatus generally requires only one variable condenser connected in shunt to the secondary winding, with the exception that for the shorter wave-lengths another condenser of variable capacity is sometimes connected in series with the antenna circuit. Many amateurs prefer to connect a variable condenser in shunt to the primary winding of the receiving transformer, but it does not increase the strength of signals though it sometimes permits closer tuning. If you possess a variable condenser of large capacity, it probably had better be connected in shunt to the secondary winding.

Your aerial, 100 feet in length and 20 feet in height, has a fundamental wave-length of about 210 meters. The July, 1916, issue of THE WIRELESS AGE contains several circuit diagrams suitable for receiving apparatus such as you describe.

* * *

W. C. L., New Orleans, inquires:

Ques.—(1) Will a ¼ k.w. transformer, having a secondary voltage between 15,000 and 20,000 volts, built in accordance with the specifications published on page 193 of the December, 1915, issue of THE WIRELESS AGE represent a transformer of efficient design and is it necessary to use a magnetic leakage gap when this transformer is operated on 110 volts A. C. to keep the lights in the circuit from flickering?

Ans.—(1) The article appearing in the issue of THE WIRELESS AGE referred to is an excellent one and is recommended to the entire amateur field in the design of an ordinary high potential transformer. The efficiency is high and the operating characteristics such that it may be operated on 110 volt A. C. circuit without causing excessive flickering of the lights. A magnetic leakage gap is not required.

Ques.—(2) Can you furnish me with the design complete of a ¼ k.w. transformer and inform me if a magnetic leakage gap is required?

Ans.—(2) Why not design a transformer after the instructions given in the December, 1915, issue. The secondary potential may be increased by an increase in the number of turns in that winding or by a slight decrease in the number of turns in the primary winding. We should prefer, however, to increase the turns in the secondary. Read carefully the article and you will obtain information that is highly valuable to an experimenter about to build a high potential transformer. You may, however, make use of the following data for a ¼ k.w. transformer which you will note does not possess the same dimensions as the one described in THE WIRELESS AGE. The primary core will be 1¾ inches square. The primary width, and when assembled the sides of the core will be 1¾ inches square. The primary winding has fourteen lays of No. 14 D. C. C. wire; approximately 5½ pounds are required. The secondary winding is wound with No. 34 enameled wire, split into eight sections, which will require about 10 pounds of wire. In this design the primary winding is placed on one leg of the core and the secondary winding on the opposite leg.

We can see no value in the diagram accompanying your fourth query. Just why you desire to so connect the apparatus is beyond our understanding and without more detailed explanation of your requirements it is difficult to advise.

Ques.—(5) How many sections of a molded condenser, having a capacity of about .0017 microfarad each, should be used with a transformer the secondary voltage of which is 15,200? This set is to be employed on a 200-meter wave. How should the condenser be connected to give the best results? Also, how many plates should be used for a 425-meter wave?

Ans.—(5) The maximum value of the condenser cannot be more than .01 microfarad. Six or seven of the uits named will give the desired capacity. The actual value of capacity to be used in either case depends, of course, upon the size of the transformer available. For work at 425 meters we recommend a capacity of .018 microfarad. This capacity will allow the proper value of inductance in the primary winding of the oscillation transformer to attain the required wave-length. The number of watts of energy that will be absorbed by this condenser will depend upon the frequency of the secondary voltage of the transformer.

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Ques.—(3) Do the steel masts of a battleship affect the sending range in the same manner a steel building on land does?

Ans.—(3) No doubt there is some absorption by these masts and the radiation would be somewhat increased if wooden masts were used.

Ques.—(4) Why does the Sayville station send at 11:30 P. M. and not at 9 P. M.? I have also noticed that it no longer sends press.

Ans.—(4) There are no German ships at present on the high seas and consequently it would be of no advantage to send press matter broadcast. The Sayville station is at present engaged in night communication with Nauen, Germany, at a wave-length of 4,800 meters, and can be heard any time after 9 P. M.

What advantage do you expect to derive by connecting four inductively-coupled receiving

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tuners in series to one aerial? Connect the four primary windings in series and the entire unit in series with the antenna itself.

* * *

R. J. F., Molalla, Ore.:

The fundamental wave-length of an antenna system for transmitting is reduced by inserting a condenser in series. Generally a condenser of this type has a capacity value of .0004 or .0005 microfarad and consists of four plates, connected in series. Four sheets of glass, 12 by 12 inches, covered with tin-foil 10 by 10 inches, the glass having a thickness of about ⅛ of an inch, will give a capacity of approximately .0004 microfarad.

Glass tubes are feasible for the support of the primary and secondary winding of a receiving tuner as far as insulation is concerned. Generally, however, the coils of receieving tuners are wound on hard rubber tubes. The thickness of the insulating tube will have no effect on the signals, provided the primary and secondary windings are not thereby too widely separated.

* * *

R. B., Milwaukee, Wis., asks:

Ques. (1) Is ¼-inch glass to be preferred to ⅛-inch glass for the secondary condenser in connection with a ¾ K. W. Thordason transformer and a rotary spark gap 8 inches in diameter, and how much of either kind should be used?

Ans. (1) Plates of ¼ of an inch thickness will make a condenser too bulky. We cannot give any definite advice in reply to the remainder of your query, for you have not furnished us with the speed of the rotary gap, the number of points in the disc and the secondary voltage of the transformer. We require this information before we can give a definite answer.

Ques. (2) Is there any way to get rid of static?

Ans. (2) None has so far been devised.

Ques. (3) How can 2 loose couplers be hooked up so as to do very selective tuning, and is it better than one loose coupler?

Ans. (3) In an early article of the series on "How to Conduct a Radio Club," you will find a full reply to this query. A fair method for making use of 2 loose couplers is to employ the interference preventer circuits of Fessenden. However, the results are not so satisfactory as might be expected. The 1911 issue of the "Naval Manual of Wireless Telegraphy" gives the complete circuits of this tuning.

Ques. (4) Can insulators be made out of fibre to be used with a ¾ K. W. transformer and if so, what size should they be?

Ans. (4) We infer that you intend to use these insulators for the secondary terminals of the transformer, and if so, we strongly advise against it. Use either glazed porcelain or polished high rubber. Fibre absorbs dampness and is wholly unsuitable for high potential work. If high rubber is used and the voltage of your transformer is about 20,000 the bushings should be at least 1¼ inches in diameter, with preferably a corrugated surface.

Ques. (5) Which type of aerial (as shown in the enclosed drawings) would you advise me to use?

Ans. (5) We prefer the inverted L flat top aerial shown in drawing No. 1.

G. W. K., Liberty, N. Y., writes:

Will a single wire aerial 500 feet long and 75 feet in height receive wave-lengths of 9,000 meters?

The aerial is too short for wave-lengths of this order. The wire should be at least 1,000 feet in length for efficiency.

In reply to your question concerning a receiving tuner for Glace Bay we advise that you avoid, by all means, winding the secondary in layers. The straight winding is preferable at all times. If you will use 1,500 turns of No. 32 wire for the second winding instead of No. 24, you will not require a double layer for the secondary winding.

A tuner suitable for Glace Bay wave-lengths is out of the question for amateur work. It is far preferable to design 2 separate and distinct tuners. However, if dead end switches were employed, the tuner could be used for amateur work as well as longer wave-lengths.

* * *

E. G., Hill City, Kan.:

Ques. (1) Explain the wiring of the buzzer employed in a radio-goniometer, in which a non-inductive shunt is used across magnet coils.

Ans. (1) The buzzer and battery are merely connected in series with the inductance coil of the wave-meter and the non-inductive shunt is connected across the terminals of the buzzer winding.

Ques. (2) Is there any difference in the oscillations set up in the primary of a "jigger" when the condenser is shunted across the secondary of a transformer and when it is in series with a jigger primary and spark gap across the secondary of a transformer?

Ans. (2) There is practically no difference in the oscillations set up in the oscillation transformer, but such a connection affords a certain degree of protection to the windings of the transformer ;that is to say, the condensers are not so apt to discharge into the windings of the transformer, burning them out.

You will find it rather difficult to work a 1-inch spark coil on a step-down auto-transformer. Spark coils are generally constructed to work on a direct current.

*Readers who submit questions to this department will greatly facilitate the work of its editor by not requesting imdiate answers. Many questions received do not appear in these columns because they are not of general interest. Every effort is made to give prompt service, but as we usually have on hand for each issue more than 5,000 queries, it is obvious that all cannot receive immediate attention.*

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# National Amateur Wireless Association

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J. Andrew White,
Editor, THE WIRELESS AGE.

MANAGING SECRETARY,
Clayton E. Clayton,
450 4th Avenue, New York.

A national organization of wireless amateurs was announced in the October, 1915, number of THE WIRELESS AGE. Further details of the organization are given in an address made by J. Andrew White, which was published in the November WIRELESS AGE. Reprint copies sent upon request.

## MEMBERS' EQUIPMENT.

**1st. CERTIFICATE OF MEMBERSHIP.**

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The National Amateur Wireless Association Pin in gold and enamel is the National emblem of the Association. The design shown on the preceding page can but faintly describe its handsome appearance in three colors and gold. The pin has a special patented hub and shank which permits it being securely fastened on the coat lapel or on the vest without turning upside down.

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**7th. MONTHLY BULLETIN SERVICE.**

It is intended to make the monthly bulletin service for members of the National Amateur Wireless Association one of the most important features of the Association. This bulletin is to be used in connection with "List of Radio Stations of the World" described above. It will carry all additions (both amateur and commercial) to "List of Radio Stations of the U. S.", issued by the Bureau of Navigation, U. S. Department of Commerce, and secured for members at 18c a copy. The Government list is issued only once a year. The Association Bulletin will keep both lists up to date for you month by month, and in addition, will carry other special and invaluable Association features not obtainable elsewhere

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THE WIRELESS AGE is the Official Organ of the National Amateur Wireless Association and will contain full reports of wireless amateur activities, both national and local. It is planned to give published recognition to individual amateur achievement.

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Those who, *during the past six months,* have become subscribers to THE WIRELESS AGE, or have renewed their subscription, or have purchased any portion of the Membership Equipment, may consider such payment as partial payment of Membership Application as given below. If you have paid for a subscription to THE WIRELESS AGE which includes books which are not a part of the Membership Equipment, then you may credit $1.25 of the remittance as partial payment on the Membership. For example, you may have remitted $2.25 for the combination offer of the 1915 Year Book with one year's subscription to THE WIRELESS AGE. In this combination, the price of both the book and the subscription was reduced, to make the special offer; therefore, you may be credited only with that part of the payment which went to the magazine—that is, $1.25. *Coupon subscribers receive no credit for trial orders.* Subscribers to THE WIRELESS AGE who *began or renewed more than six months ago,* will secure through Membership dues a renewal for another year; and their subscriptions will be extended for one year from the time the present subscription expires.

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**SPECIAL NOTICE REGARDING CORRESPONDENCE.**

**As the National Amateur Wireless Association is in no sense a money making enterprise, and as the nominal dues will cover a very small amount of handling expense, it is desired that the correspondence be limited to only the most essential necessities.** A cordial invitation is extended to all club officials to write on matters pertaining to organization. This invitation also includes those who are interested in starting new clubs.

**Charters**—Out of the amount paid by each member for annual dues, it is purposed to allow organizations that have become part of the National Amateur Wireless Association a rebate of 50 cents out of each $3.00 for their own treasury—a fund to take care of local expenses. Please note that this is a rebate, not a deduction. In order to qualify for recognition as a unit in the National Amateur Wireless Association, a club must have at least five active members and at least one-quarter of its total membership become members of the National Amateur Wireless Association. Clubs securing a charter will have representation in the National Council; this means that they elect their own delegate and thus secure a voice in the management of the Association and in the planning of its future development and activities.

**Clayton E. Clayton, Managing Secretary,**
**450 4th Ave., New York.**

---

**Checks and money orders should be made payable to: Natl. Amateur Wireless Assn.**

## APPLICATION FOR MEMBERSHIP.

CLAYTON E. CLAYTON, Managing Secretary,

NATIONAL AMATEUR WIRELESS ASSOCIATION, Date.....

450 4th Avenue, New York City.

As I desire to receive full recognition as an amateur wireless worker of the United States, I ask the privilege of enrollment as a Member in the National Amateur Wireless Association and request that you send me the complete Members' Equipment for which I enclose herewith remittance of $1.00 Initiation Fee, covering Initial Equipment, and $2.00 for First Annual Dues—or $3.00 in all. Option.*

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Street Address .....

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In the event that an applicant is unable to send the entire amount of the membership dues with this application, the figure $3.00 may be crossed out and $1.00 written in its place. This will be considered an agreement on the part of the applicant accepted for Membership that the balance of dues ($2.00) will be paid at the rate of 50c per month for the next four months, at which time pin, pennant and Certificate of Membership will be issued. The other equipment will be sent at once.

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Reference.....

Reference.....

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.....

4—Are you now a subscriber to THE WIRELESS AGE?.....

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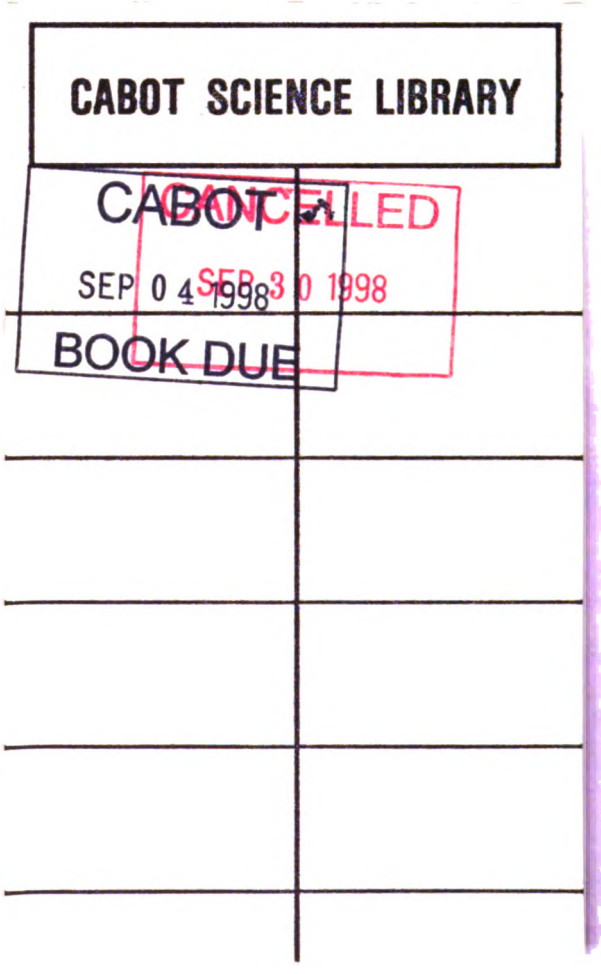


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